

No. 1709

INSTRUCTIONS
FOR MOUNTING, USING, AND CARING FOR
MORTAR CARRIAGES
MODEL OF 1896 MIII
FOR
12-INCH MORTARS
MODEL OF 1912

(SEVEN PLATES)

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By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

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12-INCH MORTAR CARRIAGE, MODEL OF 1896 MIII

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INSTRUCTIONS

FOR

MOUNTING, USING, AND CARING FOR MORTAR CARRIAGES, MODEL OF 1896 MIII, FOR 12-INCH MORTARS, MODEL OF 1912.

(Seven plates.)

(The points in *italics* are of importance and should be specially noted.)

GENERAL DESCRIPTION.

The general design of the mortar carriage, model of 1896 MIII, is very similar to the mortar carriage, model of 1896 MI, the changes incorporated in the later model being mainly in the line of greater strength.

THE EMPLACEMENT (Plate I).—This emplacement is constructed of concrete, the loading platform of which is flush with the top surface of the floor plates of carriage when it is assembled. It contains a circular well with steps on which the base ring is supported.¹ The anchor bolts and steel thrust plates for the leveling screws are embedded in the concrete when the emplacement is constructed. The edge of the loading platform proper is finished with steel angles.

THE CARRIAGE (Plates II, III, IV).—This carriage is designed to deliver an all-round high-angle fire of from 45° to 70° elevation.

With the 1,046-pound projectile and full charge the normal recoil (measured on the piston rods), is 23 inches. The maximum permissible without damage to the carriage is 24.25 inches.

The horizontal piece when fully counter-recoiled is 54 inches above the loading platform, and the projectile, in loading, is wheeled directly into the breech recess, the tray of the ammunition trucks forming the loading tray.

ACTION OF CARRIAGE.—Upon firing, the piece and top carriage rotate to the rear and downward about the fulcrum pins, compressing the counter-recoil springs and forcing the crossheads and pistons downward, until the combined resistance in the recoil cylinders and the springs stop the motion, after which the compressed counter-recoil springs immediately return the piece to the loading and firing

¹ For carriages Nos. 1 to 28, inclusive, the well is 59 inches deep; for carriages after No. 28, the well will be 61 inches deep.

height. The movement of the crank pin through the arc of a circle causes the recoil cylinders and guides to oscillate about their trunnions.

PRINCIPAL PARTS.—The carriage consists of the following principal parts, viz: Base ring and floor plates, traversing roller system, racer, top carriage, recoil system, counter-recoil springs and buffer stops, elevating gear, traversing gear, azimuth circle and pointer, elevation quadrant, lanyard attachment, electrical equipment, shot trucks, shot tongs, tools and accessories, and implements.

BASE RING.—The base ring is cast in one piece,¹ and is secured in its position by forty 2-inch anchor bolts. The outer flange of the base ring, 14 feet 3 inches in diameter, which contains 32 bolt holes, rests upon the upper step of the well, whose surface is 32 inches below the floor level of the emplacement. The inner flange, 9 feet 6 inches, contains eight bolt holes and 16 holes (2 inch-tap standard) for the leveling screws which bear on thrust plates embedded in concrete on the inner edge of the step on which the base ring rests.

The top surface is turned, forming the lower roller path, and a vertical annular flange forms the female part of the pintle, its top surface being machined as a seat for the brass azimuth circle, which is permanently attached to it by 42 bronze countersunk head screws. The traversing rack is attached on the inside below the roller path.

Sixteen floor-plate brackets (cast steel) are bolted to the outer flange with their outer ends embedded in the concrete, furnishing support for the circle of cast-iron removable floor plates. There are 16 plates retained in position by countersunk screws.

TRAVERSING ROLLER SYSTEM.—The racer rests and is traversed upon a circle of 24 live, conical, traversing rollers of steel, with a single flange. The rollers are 7.5 inches in maximum diameter, and their axes are held in the radial position by a cast-steel distance ring in six sections, in which their bronze-bushed journals have bearings. The distance ring has oil grooves finished around its top edges, reached through oil tubes in racer.

RACER.—The racer is of cast steel No. 1, cast in one piece, 14 feet in diameter. Its lower surface is turned, forming the upper roller path, corresponding to the lower roller path on the base ring. The outside annular flange extends downward, fitting inside the female part of the pintle with 0.07 inch diametral clearance. It is a cellular structure, and upon its front edge are cast four lugs or brackets on which the top carriage is pivoted by means of steel fulcrum pins.

The racer for the model of 1896 MIII carriage is cast with two longitudinal ribs, one on each side of the central opening. These ribs correspond to the side frames of the model of 1896Mi carriage, reinforcing the racer and forming bearings for the cylinder trunnions. Two racer clips of cast steel No. 3 are provided to prevent

¹ For carriages Nos. 1 to 28, inclusive, the base ring is of cast iron; for carriages after No. 28, the base ring will be of cast steel No. 2.

undue "jump" of the racer during firing. These are bolted securely to the racer in front and rear, a slight projection on their lower ends engaging a corresponding lip on the outside of the vertical annular flange of the base ring.

TOP CARRIAGE.—The top carriage of cast steel No. 3 consists of two arms connected by a heavy web. The upper ends of these arms form the trunnion beds in which the mortar is mounted. The top carriage is inclined to the rear at an angle of about 41° , the lower ends being held by the fulcrum pins. Between the fulcrum and the trunnions are placed openings for the spring guide rods and the seat for the rocking counter-recoil spring cap.

RECOIL SYSTEM.—The recoil is checked by two hydraulic cylinders provided with trunnions, which oscillate in their beds on the longitudinal ribs of the racer, their lower ends extending some distance below the racer. They are of cast steel No. 3, 8.625 inches interior diameter, and are fitted with 3.5-inch forged steel C piston rods working through stuffing boxes at both ends of the cylinders. About the middle of the rod is screwed a bronze piston, which is forced on and finished in place. The stuffing boxes each contain six rings of 0.625 inch square Garlock waterproof hydraulic packing. In the walls of each cylinder are cut three grooves, each subtending an angle of $77^{\circ} 30'$ and of varying depth, so as to give a constant pressure in the cylinders during the entire length of recoil. The energy of recoil is taken up by the resistance which the fluid offers to being driven through these openings.

The counter-recoil is checked by a counter-recoil buffer, the male part of which is on the piston and the female part on the cylinder head. At the end of counter-recoil the former enters the latter, imprisoning oil, which is able to escape by the clearances only, its resistance gradually checking the return movement and permitting the mortar to return into battery gently and without shock.

The filling holes are located about the middle of the cylinders in order to obtain a void.

For all charges the cylinders should be filled to the level of the filling holes, removing for this purpose both plugs, so as to permit the air to escape.

A neutral oil, of specific gravity of about 0.85 (such as the "Hydro-line" at present issued), is used, and with this oil the working pressure in the cylinders is about 5,825 pounds per square inch and the piston-rod compression about 282,750 pounds. A denser oil would cause a higher pressure in the cylinders and therefore shorten the recoil slightly.

If it is desired to measure the recoil, it can be done on one of the piston rods by making several turns around it with fine twine and tying it tightly just where the piston rod enters the stuffing box.

The height of the twine above the stuffing box, after firing, will indicate the counter-recoil, which will also be the recoil if the mortar has returned to the firing position. If it does not return to the firing position, the counter-recoil springs should be compressed.

The lower ends of the hydraulic cylinders are connected by an equalizing pipe, in which is made up an emptying coupling of forged steel No. 2, so that the resistance and the pressure in both cylinders shall be equal. The coupling is provided for emptying the cylinders at a convenient point.

Three bronze plugs, including one extra, are provided, which can be used to replace the equalizing pipes, thus continuing the piece in action after their injury.

To the top of each cylinder are bolted two guides of cast steel, No. 3, between which moves a sliding crosshead of forged steel No. 3, into which the upper end of the piston rod is secured by mean of a collar and nut. The crossheads are assembled over the crank pins, of forged steel No. 3, which are screwed into the cast steel No. 3 trunnions of the mortar and held by spline screws.

COUNTER-RECOIL SPRINGS AND BUFFER STOPS.—The top carriage is supported at a point about one-third of its length from the fulcrum shaft by four columns of springs.¹ Each column consists of five double-coil helical springs, threaded on a spring guide rod of forged steel No. 3. These rods, arranged in a row side by side, serve to guide the springs laterally during recoil or counter recoil. They are also used to sustain the force of the springs when the mortar is dismounted temporarily—the spring compressors assisting.

For the latter purpose the forged steel spring-compressor washers are placed over the spring-compressor screws and the latter screwed into the ends of the rods (the plugs having been removed), after which the spring-compressor nuts are screwed down against the washers, until the crossheads are moved a short distance from the buffer plates.

The lower ends of these spring columns rest in a spring box of cast steel and the upper ends bear against a spring cap of cast steel. The spring box is hung, by means of trunnions, in two brackets of cast steel bolted to the under surface of the racer, which permit it to oscillate during recoil to the different inclinations of the spring columns. The spring cap, performing essentially the same office above as the spring box does below, is a thin rectangular steel casting fitting over the top of the spring columns, and having upon its upper surface a well-rounded knife-edge bearing. During recoil this bearing rocks in a groove running across the lower surface of the top car-

¹ In the design of the carriage provision has been made for assembling a fifth column of springs if found necessary to insure full and prompt return into battery. In the normal case, however, the middle column should be omitted, as the four columns are amply strong to bear the designed load, 100,000 pounds.

riage. Both the spring cap and box are perforated to allow the ends of the spring rods to pass freely through them.

As an additional precaution against shock when returning to the firing position, buffer stops are provided. These are made up of alternate layers of balata and steel plates and are held between the guides under the caps. The crossheads moving between the guides during counter recoil strike these buffers when the mortar returns to the firing position and are maintained in pressure contact under the guide caps by the counter-recoil springs.

ELEVATING SYSTEM.—A circular rack of cast steel No. 3 is bolted longitudinally to the mortar on the underside, so that the center from which its pitch line is struck is at the intersection of the axes of the trunnions and bore. This rack engages in a pinion of forged steel mounted on a heavy shaft on the undersurface of the top carriage, which also carries an elevating gear of bronze No. 4, to which motion is given through intermediate gears by a second shaft extending across the upper face of the top carriage and bearing a handwheel at each end. The top carriage is cored out to permit the passage of the rack, which has a notch 1 inch deep cut in its upper web at the proper place to engage the locking pawl which retains the mortar in its loading position.

The mortar is held in the firing positions by means of a hand nut on the handwheel shaft, which locks that shaft by pressing the thrust collar against an adjoining bushing, which together form a conical friction clutch.

To protect the teeth on the elevating gearing from injury which may be caused by inertia effects during the change of elevation in recoil, the elevating shaft carries a friction device. This device consists of alternate bronze No. 4 and cast-iron disks working in a recess of the elevating gear. The bronze rings are caused to rotate with the elevating gear and the cast-iron rings with the elevating shaft by means of keys, but the keying does not prevent motion in the direction of the axis of the shaft. By means of a nut, plate, and coiled spring on the elevating shaft the rings are forced together and against the elevating gear, thus forcing the latter against a shoulder of a bushing which is rigidly fastened to the elevating shaft. The elevating gear is not fastened rigidly to the shaft or to the bushing, but with the nut and spring the pressure between them can be made great enough to prevent any slipping during elevating or depressing or an undue amount of slipping during recoil. This pressure will be properly regulated if the united effort of one man applied at each of the handwheels is just sufficient to cause a slipping when an attempt is made to depress below the minimum.

To hold the mortar in the horizontal position for loading and insure against accidental elevating when the breech is open, an elevation

locking device is provided on the left side of the top carriage. This consists of a pawl, pawl shaft, and pawl lever attached to the top carriage. A spring forces the pawl downward into engagement with a notch in the elevating rack, automatically locking the mortar when horizontal. To elevate the mortar, the pawl lever must be lifted and held up by hand until the mortar has moved sufficiently in elevation for the pawl to clear the notch in the elevating rack.

On each side of the elevating rack is placed an auxiliary elevation scale graduated in 10-minute intervals. Pointers attached on each side of the opening in the top carriage indicate the elevation of the mortar.

TRAVERSING SYSTEM.—The circular traversing rack on the inside of the base ring has meshing with it a pinion on a vertical shaft of forged steel No. 1 which passes down through the racer and having at its upper end a worm wheel. Motion is given the latter by means of a handwheel mounted on a worm shaft. The worm shaft, worm wheel, and the part of the vertical shaft above the racer are incased in a cast-steel pedestal which has oil and drain holes so arranged that the worm and the gear rim run in oil.

Due to the accuracy with which the traversing rack, pinion, worm, and worm wheel can now be machined, it has been possible to dispense with the traversing brake which was required on earlier models to maintain the piece in azimuth until fired.

AZIMUTH CIRCLE AND POINTER.—A brass circular strip in six sections, about 2 inches wide and graduated to degrees, is attached to the top side of the outer flange of the base ring. Attached to the racer near the traversing pedestal, and bearing on the azimuth circle through an opening in the racer, is a small brass pointer or subscale. This pointer is subdivided to 0.05° and stamped in hundredths of a degree. An electric light is attached for illuminating the scales, and a cast-steel lid and coaming is provided to protect the subscale and light from mechanical injury.

ELEVATION QUADRANT.—To save time in bringing the mortar to the desired elevation and to avoid inaccuracy in placing the quadrant and holding it against its seat, a special elevation quadrant has been designed. This quadrant is similar to the gunner's quadrant, but permanently attached to the left rim base of the mortar, and consists of a bracket with a toothed arc and an arm hinged at the other end. The arm is telescoped, and its front bushing carries a bubble, a micrometer, and a toothed sector which is constantly pressed outward by a spiral spring. The teeth of the sector engage in the teeth of the arc, which are cut in degrees from 45° to 75° . The micrometer, which gives a limited movement to the arm, is graduated to a least reading of one minute. When the quadrant is set to the required

angle of elevation and the piece loaded, the mortar is given the proper elevation by bringing the bubble to the center of the tube.

A canvas cover has been provided *which should be kept on the quadrant when not in use.*

LANYARD ATTACHMENT.—A short lanyard is attached to the underside of a stopper in the top of the racer in rear of its central opening and extends below a pulley in the pit, thence upward to the safety lanyard device, and thence to the firing mechanism. The safety lanyard device consists of a bridle clip fastened to the plug set in the face of the breech, and a ring fastened at such a distance from the hook end of the short lanyard that the hook of the lanyard and ring can be fastened to the firing mechanism and the bridle clip. While loading and laying the mortar the ring should be on the clip. A pull on the lanyard is resisted wholly by the bridle clip, which will not permit the ring to slip off and allow a pull on the firing mechanism until the mortar has attained an elevation of about 43° .

The long lanyard is hooked into the eye on the top of the stopper and the stopper and short lanyard drawn to the rear to fire.

ELECTRICAL ATTACHMENTS.—The electrical attachments consist of the firing circuit, its safety attachments, and the lighting circuits.

FIRING CIRCUIT.—The current for the firing circuit will be generated by a small hand-operated alternating current magneto located in the battery commander's station. The details of this device as applied to mortar batteries have not as yet been decided upon, but will in any case conform to the other parts of the firing circuit as described below. The conduits and wiring from the battery commander's station to each mortar well are furnished and installed by the Engineer Department in accordance with General Orders No. 1, War Department, 1913. The Engineer cable, type 1, terminates in a water-tight receptacle box (E25H) bolted to the underside of the base ring. When not actually in use this box is kept closed by means of a screw cover and rendered water-tight by a rubber gasket.

The connection between the fixed base ring and the rotating racer, etc., is accomplished by means of ordinary twin conductor of 2,583 circular mils, cross section, stranded, rubber covered, braided and waxed. To facilitate connecting up, the inlet end of this twin conductor terminates in a plug (E25Z) which can be quickly inserted in the receptacle referred to above, the joint being kept water-tight by means of a brass collar which is screwed directly to the receptacle cover. From the inlet-receptacle box on the base ring the twin conductor is led vertically downward to the bottom of the well, thence beneath two hooks which keep it always below the spring box to a double pulley centrally located on a three-legged bracket which straddles the emplacement drain. From the pulley the twin conduc-

tor is led to the left horizontal rib of the racer, where it terminates in a receptacle box (E25J) supported by two studs and retained by split pins. This receptacle box is similar to that previously mentioned, but, instead of a screw cover, is provided with a spring cover which closes automatically whenever the safety firing plug is withdrawn, thereby preventing access of water to the interior of the receptacle.

The safety firing plug (E25AA) is similar to that already described, except that it is not provided with a collar for making a water-tight joint when inserted in the receptacle. This is, however, unnecessary in this case, as the plug is only inserted when ready to fire, and is immediately and automatically withdrawn when the mortar is depressed after firing. From this plug another length of twin conductor, looped slack in order to let the plug chain take the strain, leads to a small transformer mounted on the face of the breech. The purpose of this transformer is to provide a break in the metallic circuit between the magneto and the primer, thereby minimizing to a great extent the possibility of premature firing due to accidental grounds or crosses between the firing and lighting circuits. For use with a single-wire primer one of the secondary leads of the transformer is grounded directly to the mortar and the other is led to an insulated contact piece which completes the circuit with the corresponding part on the breechblock when the mortar is completely rotated to its locked position.

LIGHTING CIRCUIT.—Current for the lighting circuit, 110 volts direct current, is supplied by the Engineer Department from the emplacement mains, and is led into each well by Engineer cable, type 1, terminating in a water-tight receptacle (E25AB) as previously described for the firing circuit. The connection between the fixed base ring and rotating racer, etc., is accomplished in a manner similar to that for the firing circuits, except that the outlet end of the lighting circuit terminates in a plug (E25AD) similar to that in which the inlet end terminates. In connecting up the lighting circuits this plug is inserted into a receptacle (E25AB) which is permanently screwed into a junction box (E21T) located on the inside face of the racer opening. From this junction box radiate the circuits for the azimuth lamp, elevation quadrant lamp, and portable lamp. These circuits are made up of twin conductor, lead-covered, steel-armored cable, each conductor of 4,110 circular mils cross section, both ends secured to their respective terminal joints in a water-tight manner by the use of stuffing tubes (E21Z). The circuit for the azimuth lamp passes around the inside of the racer opening until it reaches the depression for the azimuth pointer, where the cable is connected up to a water-tight receptacle box (E22N) which supports the azimuth lamp and reflector (E12P2). The circuit for the quadrant lamp leads to the upper part of the left crosshead guide where the cable is connected to

a water-tight receptacle (T95P) which supports the quadrant lamp and reflector. The circuit for the portable lamp passes to the rear and is connected to a portable lamp plug box (E20B) located between the left longitudinal ribs of the racer. Plug box and portable lamp are furnished by the Engineer Department.

SAFETY FEATURES.—In order to prevent possible accidents due to the crossing of the firing and lighting circuits, the plugs (E25AD) and (E25Z) are made noninterchangeable in that the firing plug can not be inserted by mistake in the lighting receptacle on the base ring. The insertion of the lighting plug in the firing receptacle would obviously cause no damage, but in order to prevent mistakes the words "Firing" and "Lighting" are cast in raised letters on the covers of the corresponding receptacles wherever used.

In order to prevent accidents due to firing at too low an elevation, the safety firing plug is suspended from the breech of the mortar by a chain whose length is determined by trial as only sufficient to permit contact to be made at elevations of 43° and above. Automatic closing of the firing circuit at this point is omitted advisedly.

CARE OF ELECTRICAL EQUIPMENT.—The electrical equipment can be divided generally into two distinct classes—the permanent, rugged, and expensive installation of armored cable and water-tight accessories on the base ring and racer; and the less rugged and correspondingly inexpensive but easily replaceable twin conductor, *which should be removed from the carriage and stored in a clean and dry place when not actually in use.* In the second class are included the complete firing circuit and that part of the lighting circuit between the inlet at the base ring and the junction box on the racer.

SHOT TRUCKS AND SHOT TONGS.—The shot trucks for this carriage (type 12MD) are constructed so as to admit of passing the projectile directly from the truck into the mortar. Each truck consists of a light framework of steel angles and plates mounted on two rubber-tired wheels and one caster and carrying a shot tray, in which the projectile lies horizontally and at the proper height for loading. This tray projects to the front and is designed to enter the breech of the mortar and to supply the place of the usual loading tray. A straight wooden bar which slips into sockets in a bracket at the rear of the truck serves as a handle, and the rear wheel or caster is swiveled to facilitate turning. A hand brake is provided for holding the truck firmly in position against the breech while loading or unloading. Shot tongs are also provided for placing the shot on the shot truck. One pair of tongs is provided for each carriage.

TOOLS AND ACCESSORIES AND IMPLEMENTS.—The carriage is equipped with the tools and accessories necessary for its assembling and care. These parts, together with the implements for the mortar, except those too large, are stored in an armament chest.

ASSEMBLING THE CARRIAGE.

IMPLEMENTS.—The assembling requires machines and implements for mechanical maneuvers usually found at forts, such as shears, falls, blocking, jacks, sling chains, etc.

GENERAL REMARKS.—The size of the carriage is such that it must be dismantled for shipment, so that when it arrives at its destination it has to be entirely assembled.

In assembling the carriage, as in all machinery, no parts should be directly struck with a steel hammer or sledge. Soft-metal drifts or copper or lead hammers should be used.

In unloading or handling the parts care should be exercised that the edge or finished surfaces do not become upset or burred. When two bearing surfaces are brought together it is especially necessary that both parts should be absolutely clean, smooth, and well lubricated.

In mounting the carriage the top, bottom, and back of the cross-head, the buffer plates, and that part of the top carriage behind the guides will be painted before assembling. These parts are not accessible after being mounted, and if not thus protected would rust badly.

In assembling guides, or machined surfaces put on a thin coat of light slushing oil; slush all bolts and threads. No light slushing oil will be applied to the rollers and paths, as its use would quickly result in the accumulation of dust and dirt, thus causing the parts to become gummed; simple oiling is all that is required.

The following description gives a statement of the order in which the parts should be put together rather than a complete enumeration of the details of the operation:

BASE RING.—The annular cavity on the under side of the base ring is filled with neat Portland cement before being moved to its position over the anchor bolts by means of skids and rollers. When the holes in the ring are directly over the corresponding bolts, lower by means of jacks, being careful to lower all at the same time. If it should be necessary to engage under the toothed rack by means of the lugs on the jacks, use three jacks about 120° apart, putting a piece of soft wood on top of each shoe. Repeat the operations of lowering until the ring is on its bed, having the bolts as nearly central in the holes as possible. On each side of every inner anchor bolt there should be a steel thrust plate 0.75 inch thick and 5 inches square, on which the 16 leveling screws bear. These screws and plates serve to give the base ring proper support, enabling it to be easily leveled and also permit the grouting to become well set without deformation, while the remaining parts of the carriage are being assembled.

LEVELING.—A sensitive machinist's level and an accurate steel straightedge should be used in leveling all parts.

The threads of the anchor bolts and nuts and leveling screws should be carefully examined to see that they are not burred and are free from rust. After they are put in order, oil thoroughly the threads of both bolts and nuts. In screwing down the nuts on the platform bolts take up ~~on~~ each bolt a little at a time, so that no part of the base ring shall be strained. The greatest care must be exercised in using the "level" and "straightedge" that the middle of the level is equidistant from the points of contact of the straightedge with the surfaces being leveled and that these points of contact on the straightedge are equidistant from either end.

In using the level it should always be reversed and the mean of the readings in the two positions considered the true reading. The preliminary leveling may be done from the top of the pintle, if machined, but for the final leveling the straightedge should be placed on the turned surface of the roller path, following around circumferentially first in one direction and then in the other, leveling by tightening the foundation bolts and loosening the adjacent leveling screws until no high spots are found. After the base ring is properly leveled and fixed in place, pour under it a grouting of neat Portland cement, being careful that the part below the level of the outside flange is thoroughly embedded. Fill the spaces between the bolts and bolt holes with melted lead. After the grouting is well set, back off the leveling screws slightly. If not already attached, the brass azimuth circle should now be assembled by means of the countersunk head screws provided for the purpose. The top surface of both circle and screws should then be finished smooth by filing.

DISTANCE RINGS AND TRAVERSING ROLLERS.—Clean the lower roller path and rollers very thoroughly with kerosene oil and fine emery cloth and then assemble the rollers and distance rings. After this is done run the rollers around several times by hand to see that they run freely and do not bind or stick against the distance rings.

After the base ring has been leveled the floor-plate brackets are bolted thereto, and their outer ends grouted at the points where they are supported by the shallow ledge at the edge of the loading platform. The floor plates are then placed in position and the spaces on the ledge between the floor-plate brackets are grouted to insure fair bearing of the outer edges of the floor plates.

RACER.—Before assembling the racer the upper roller path should be cleaned in the same manner as described for the lower path, and the pintle surfaces on both racer and base ring should also be cleaned with kerosene oil and emery and then thoroughly oiled. Then place the spring box, with its brackets on it, inside the base ring, in about the position it will finally occupy, with the top surface of the feet of the brackets not higher than the floor level of the emplacement. By means of skids and rollers the racer can now be moved over its proper

place, seeing that its lowest part is not less than 12 inches above the floor level of the emplacement. While in this position raise the spring-box brackets and spring box, by means of jacks and blocking, to their proper position against the under surface of the racer and then bolt firmly to the racer by means of the studs which pass through the feet of the brackets. (If means are at hand to turn the racer bottom side up, the spring box and its brackets can be more easily and more securely assembled while in that position, after which the racer is placed in position for lowering.) Lower the racer onto the rollers; this can best be done by means of three jacks placed 120° apart, care being taken to keep blocking under it and to remove a little at a time. When in place, run it around several times by hand, to see that it runs freely and the pintle surfaces do not bind.

CLIPS, LADDER, AND DUST GUARDS.—Now put the racer clips in place on the racer and bolt down with the tap bolts provided for the purpose. Bolt the ladder to the right surface and the lanyard bracket support to the rear surface of the racer opening. After this the dust guards, in four sections, can be bolted on the lower interior flange of the racer just inside the roller path.

RECOIL CYLINDERS.—To prepare the cylinders for assembling, remove the guides and caps and then the crossheads, take out the top cylinder heads and remove the piston rods, clean thoroughly and also wipe the cylinders dry, then oil the piston rods and replace them and the cylinder heads.

Removal of the piston rods will necessitate reassembling and repacking the stuffing boxes. (See "Care of the Carriage.")

Now clean the trunnions of the cylinders and then lower the cylinders into their respective openings in the racer and bolt on the cap squares.

TOP CARRIAGE.—With the aid of rollers run the top carriage bottom side up to the front of the racer and set in the fulcrum pins and their keys and set screws. Using shears, gin, or jacks, raise the trunnion-bed end of the top carriage up past the vertical until it inclines well to the rear, when it should be braced preparatory to receiving the mortar. The cap squares should now be removed.

COUNTER-RECOIL SPRINGS.—To assemble the springs, the center of the mortar trunnions should be about 5 feet 9 inches above the racer. Put four springs in the spring box, omitting the middle one, and lower through them the spring rods with the locking and adjusting nuts down against the fixed nuts. Now assemble the springs and washers on the rods, four on each rod above washers, and with the aid of a tackle let fall to their approximate position against a scantling which has previously been located. The spring cap should then be placed in position.

TO MOUNT THE MORTAR BY BLOCKING the following articles are required: Oak rollers 3 feet long; one cradle 18 feet long and 3 feet wide; two 12-inch timbers 26 feet long, and two of the same length as the cribwork; a quantity of 2-inch, 6-inch, 8-inch, and 12-inch blocking, and three hydraulic jacks of 15-ton capacity. On the emplacement floor in front and rear of the racer make two parallel cribworks of blocking longer than the width of the top carriage. They should be sufficiently high to allow the two long 12-inch timbers now laid from one crib to the other, to clear the top carriage. The outer faces of these pieces should be within the planes of the inner faces of the trunnion beds.

Build a runway in front of the carriage, so that the mortar on the cradle can be moved on the track just formed, and bring the trunnions of the piece over their beds. Carefully chock the rollers.

TO REMOVE CRADLE AND TRACK.—Insert a heavy block in breech of mortar, allowing it to project 1 foot outside. Place head of hydraulic jack under this block close to breech and its foot on the cradle and raise sufficiently to pass a 12-inch timber between mortar and cradle at right angles to mortar, and block up each end on cribwork outside of cradle. The crosspiece must now clear the cradle. Repeat the operation at muzzle and chock the piece front and rear. Remove cradle, rollers, and track.

TO LOWER THE PIECE.—Jack up the breech as above described, remove sufficient of the crib to allow a 4-inch drop, and lower the breech onto the cross timbers. Do same at muzzle, and continue until trunnions are in their beds. Then bolt on the cap squares.

The clearance between crosshead guides and end of trunnion is small, so great care must be taken in lowering.

Remove the braces supporting the top carriage and lower the mortar and top carriage against the springs, the top carriage rotating about the fulcrum. It will be necessary to guide, with a crowbar, the spring rods through the openings in the spring cap and top carriage. If the weight of the mortar and top carriage is insufficient to compress the springs enough to enter the piston rod nuts in the crosshead, the latter having previously been bolted to the crank pins, a tackle should be used to draw the gun down.

TO CONNECT THE PIECE WITH THE RECOIL SYSTEM.—Screw the piston rod nuts with great force into the crossheads, assemble the guides to the cylinders, embracing the crossheads, and bolt on the guide caps with their balata buffers. See that the guides and crossheads are well cleaned and oiled before they are put in place. Connect the equalizing pipe with the recoil cylinders.

ELEVATING GEAR.—Slip the elevating rack through the hole intended for it in the top carriage and bolt it securely to the mortar.

Slide elevating shaft through its bearings, friction device, and elevating pinion, screwing up on the clutch spring, adjusting nut at the same time. Bolt elevating nut pin bracket to the underside of the top carriage. Slide elevating intermediate pin through its bearings and elevating intermediate gears, and fasten with tap bolt. Place in position the idler pin and elevating idler gear, fastening with tap bolt. Bolt in place the elevating handwheel-shaft brackets and assemble in position handwheel shaft with handwheels and collars. Assemble pawl, pawl shaft, pawl lever, and pawl spring.

ADJUSTMENT OF SPRINGS.—After the mortar is in position it may be found that the springs have not been compressed sufficiently to hold the mortar in the firing position, and that there are open spaces between the crossheads and the caps on the crosshead guides. These spaces must be closed by an additional compression of springs. For this purpose the lock nuts on the five spring guide rods are loosened and the necessary compression given by the adjusting nuts, the spindles being held from turning by means of the fixed nuts immediately over the loose springs. During the adjustment of the springs the mortar should be occasionally jarred against the stop on the top carriage by means of the elevating handwheels. The elevation lock must be held unlocked when the mortar is jarred against the stop, in order to prevent the breaking of the lock when the mortar rebounds from the stop. The proper compression is given when the springs will hold the crossheads in pressure contact under the guide caps.

If necessary to insure full and prompt return into battery, the middle column of springs should be assembled, and the other columns adjusted accordingly.

TRAVERSING MECHANISM.—Thoroughly clean all the traversing mechanism preparatory to assembling, first detaching the parts which have been shipped assembled. Then put the worm and worm wheel in the pedestal brackets, engage the gears, and insert the worm shaft. Next put the vertical traversing shaft through the pedestal bracket from the lower end. Key the upper end of the shaft to the worm wheel, put on the washer and nut, and insert the split pin. Bolt the bracket for vertical traversing shaft to its pad on the underside of the racer. Support the traversing pinion in its place, engaging the rack, shrouded side up. Lower the assembled pedestal bracket, allowing the vertical shaft to enter its lower bearing and pinion. Bolt the pedestal bracket to its pad on the racer and attach the traversing handwheel. If necessary, turn the handwheel to adjust the keyway for the traversing pinion and secure the pinion with key, washer, and nut. Put on the cover.

IMPORTANT POINTS.—After the carriage has been completely assembled and the mortar mounted, the following points should be noted, viz:

1. Traverse the carriage each way and elevate and depress the mortar, to see that they work freely.

2. Examine and clean out all oil holes, noting that they have oil plugs.

3. See that there is not a hard bearing between the rim bases of the mortar and the top carriage, between the crossheads and crank pin shoulders, and between the cylinder-rim bases and their bearings, as these conditions would indicate parts out of alignment.

4. See that the elevating rack is firmly attached, that the counter recoil springs maintain the mortar fully "in battery," and that the elevation stop permits the piece to be depressed to horizontal position so that projectiles can be rammed without interference.

5. See that the dust guard does not bind or rub on the traversing rack nor the azimuth pointer on the azimuth circle.

6. Attach the elevation quadrant, using a clinometer supported by a rest in the muzzle of the piece while fitting it to test its adjustment. With the piece set horizontal the leveling of the base ring can be tested by traversing to each 90° position and noting the reading of the clinometer.

7. Orient the gun, add numbers to the degree marks on the azimuth circle, and adjust azimuth pointer to indicate correct azimuth. Muzzle at true south is 0° in azimuth and numbers are placed around clockwise to include 359.

8. See that electrical connections have been properly made by trying the lights and the firing circuits.

TO DISMOUNT CARRIAGE FOR PURPOSE OF CLEANING TRUNNIONS AND SPRINGS.—Remove crosshead guides and guide caps and unscrew piston-rod nuts. Then with the aid of jacks, skids, and blocking raise the mortar, the carriage rotating about the fulcrum until the center of the trunnions is about 5 feet 9 inches above the racer. The spring cap, spring washers, and rods can then be removed. With the springs out the trunnion-cap squares can be removed and the top carriage lowered sufficiently to clean the trunnions and their beds. The same operation in the reverse order should be followed when assembling.

CARE OF THE CARRIAGE—GENERAL INSTRUCTIONS.

Carriages should be traversed from time to time through their entire movement and left at a different azimuth each time.

It is especially required that all parts of the carriages must be kept free from rust *at all times*. If this be allowed to accumulate its removal from all bearing parts, and especially piston rods, requires particular attention in order that clearances shall not be unduly increased. The use of sandpaper for this purpose is forbidden, and emery cloth No. 1, being coarse enough for any ordinary rusting, should be used, the rust being softened, if necessary, by kerosene.

If any leakage occurs from the hydraulic recoil system, it should be immediately remedied, calling, if necessary, upon the district armament officer for the services of skilled labor.

The repacking of stuffing boxes may be done when necessary by trained enlisted men under the supervision of an officer, but will preferably be done by skilled labor.

Before removing a cylinder head containing a stuffing box, or drawing a piston rod through a stuffing box, the pressure of the packing on the rod should be released by unscrewing the follower several turns.

The vulcanized fiber or copper gaskets between cylinders and their heads should be in good condition and consequently should be replaced whenever necessary in order to prevent leakage.

Recoil cylinders should be emptied at least every three months and thoroughly cleaned every six months.

CLEANING RECOIL CYLINDERS.—For this cleaning a plumber's hand force pump will be supplied to each Coast Artillery post, with about 10 feet of suction hose and 15 feet of discharge tube.

It will be noted that in no case will it be necessary to remove the packing from a stuffing box to clean the cylinders.

In cleaning, the following order of operations may be followed:

- (a) Remove oil from cylinders and equalizing pipes.
- (b) Compress the counter-recoil springs by means of the assembling screws, so as to lower the mortar a few inches, remove the guides and caps and disconnect and remove the crossheads.
- (c) Unscrew the cylinder heads and carefully withdraw the piston rods out of the cylinders. Each part dismantled should be marked to insure its being assembled in its correct place.
- (d) Thoroughly clean the cylinders with kerosene oil forced from a hand pump into both ends of each cylinder. The plug in the emptying coupling should be removed and both branches of the equalizing pipe flushed out from their cylinder ends. Then wipe the interior of the cylinders dry with clean cotton waste and clean the piston rods and cylinder heads.
- (e) Replace the emptying coupling plug, assemble the piston rods, cylinder heads, crossheads, caps, and guides, exercising great care that none of the parts are burred or otherwise damaged. The cylinder heads should be firmly screwed into place, care being taken that the packing ring is in good condition and properly placed. Screw the followers tight against the packing in the stuffing boxes.
- (f) All parts dismantled should be carefully inspected to ascertain that they have been properly assembled.

REMOVING PACKING FROM STUFFING BOXES (using new extractor furnished by the Ordnance Department).—Close the extractor around the piston rod and insert the locking pin. Turn the extractor to the left, with pressure on the packing, until the needles are firmly

engaged in the packing. Draw the packing out, turning slowly to the left. In the case of a box with interior thread and if the ring is tight it should be unscrewed and not stripped out by the thread, because unless unscrewed it would catch upon and be injured by the thread.

Extractor bars are provided to be used for starting the packing from its seat and by inserting the toes of the bars in the rack teeth and prying over the edge of the box, being careful not to injure the thread.

TO PACK A STUFFING BOX.—To pack a stuffing box, after drawing the oil from the cylinders, remove the follower and with it the rings and all the packing in the box. Examine the old packing and discard all unfit for use. If any of the old packing is used, it should be put in after the new.

In packing a stuffing box put on the piston rod one ring of 0.625 inch Garlock's "waterproof hydraulic" packing, and force it well to the bottom of the stuffing box by a wooden stick and mallet. Treat each layer of packing in a similar manner, until the required amount, with the old on top when any of the latter is used, is inserted.

Put the halves of the ring on the follower, enter them together in the box, and screw up the follower, being careful to note that the halves of the ring do not bind on the screw threads.

No more force should be used on the spanner wrench than that of two men, and generally that of one man is sufficient. The addition of a pipe to the end of a spanner wrench should not be permitted.

When the box is properly filled and the follower tightened there should be for the lower boxes not more than 1 inch of space between the flange of the follower and the piece into which the follower is screwed. For the upper boxes there should be not less than 24 inches between the followers and the piston-rod nuts.

The follower should be tightened from time to time. If the follower is screwed into the stuffing box too tightly, an unnecessary amount of friction will be produced on the piston rod. When the follower is screwed in until the flange strikes the box another ring of packing should be inserted.

It is to be expected that a slight amount of oil will soak through and drip from boxes or carriages when not in use. Also, when tightening the followers a slight amount of oil will squeeze out of the saturated packing. This oil should be caught and not allowed to render the carriage unsightly.

FILLING RECOIL CYLINDERS.—To fill the cylinders with oil, remove the two plugs, one in each cylinder. Pour clean neutral oil of specific gravity about 0.85 (such as the "hydrolin" now issued to the service) into the hole of one cylinder until it flows out of the hole of the other. Allow any air that may be present to escape, then pour in more oil

until the same is level with the filling holes. About 10.6 gallons are required.

SERVICE CONDITION (lubrication, etc.).—When the carriage is to be kept in readiness for service and is in daily or frequent use all bearing parts must be kept clean and lubricated. Special attention should be given to the lubrication of trunnion bearings, cross heads and guides, rollers, pintle surfaces, elevating rack and gears, and traversing mechanism, including the teeth of all gears.

The above parts should be lubricated at frequent intervals whether the carriage is maneuvered or not. When carriages are in use for daily drills a thorough lubrication twice each week should be sufficient for all but the most severely used parts.

Proper lubricating and cleaning of the traversing rollers and their paths are essential to the free working of the carriage.

When oiling the rollers or the pintle the carriage must be traversed in order to distribute the oil throughout the whole circumference.

It will occasionally be necessary to examine the rollers, to see that the dust guards are in proper place and that the rollers themselves are clean. If they are found dirty they must be cleaned with kerosene oil, but care must be taken to fill the bearings with synovial oil after the kerosene has been rubbed dry. Experience has shown that recoil cylinders should not remain empty, as in that case the interior walls soon become rusty.

OIL HOLES.—Oil holes, where provided, must be cleaned out frequently to keep them free from sand and grit and will habitually be kept closed by the screw plugs provided, except when in the act of oiling.

Before oiling at any hole wipe off carefully any dirt or grit near the opening that might be carried down into the bearing by the oil.

COMPRESSION GREASE CUPS.—Where compression grease cups are provided similar precautions against dirt or grit must be observed. In filling these cups do not fill the cup completely, but fill only to the bottom of the bevel at the top of the cup; if too full, the leather packing will become inverted and will not act effectively. In putting on the cap see that the leather-packed follower enters the cup without being caught, cut, or bent by the edge of the cup, or otherwise. Screw the cap down on the cup, using a wrench, if necessary, to secure sufficient power, until the spring rod projects about 0.25 inch above the top of the cap. Later, when the spring has recovered and has moved the follower forward, forcing the grease through the tube into the bearings, which will be indicated by the spring rod being pulled into the cap until its nut touches or nearly touches the cap, it will again be necessary to screw up the cap on the cup until the spring is again compressed. When the cap is screwed nearly home and the

spring rod does not project it is an indication that the cup should be refilled.

For further information regarding paints, oils, cleaning material, and methods of using same see Ordnance Department pamphlet Form No. 1869. Annual allowances will also be found therein.

See also Circular No. 29, War Department, 1910.

NAME OF PARTS OF 12-INCH MORTAR CARRIAGE, MODEL OF 1896 Mm.

Their piece marks, location, and material of which they are made.

The parts are listed alphabetically under the following headings: Carriage proper; the Electrical equipment, including the Firing circuits; Shot trucks; Shot tongs; Lanyard attachment; Elevation quadrant, and Grease cup.

When referring to a part always mention its piece mark, where given on the list:

| | | | |
|-----------------|---------------------------------------|------------|----------------------|
| Br..... | Brass. | L..... | Lead. |
| Bz..... | Bronze. | M. I..... | Malleable iron. |
| C..... | Copper. | P. Bz..... | Phosphor bronze. |
| C. I..... | Cast iron. | S..... | Steel. |
| C. R. S..... | Cold rolled steel. | S. B..... | Sheet brass. |
| C. S..... | Cast steel. | S. S..... | Sheet steel. |
| F. V. F..... | Flexible vulcanized fiber. | Sp. S..... | Spring steel. |
| G. I..... | Galvanized iron. | V. A..... | Vulcanized asbestos. |
| G. S..... | German silver. | V. F..... | Vulcanized fiber. |
| G. W. H. P..... | Garlock waterproof hydraulic packing. | W. I..... | Wrought iron. |
| H. R..... | Hard rubber. | S. R..... | Soft rubber. |

12-INCH MORTAR CARRIAGE, MODEL OF 1896 Mm.

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|-----------------------------------|--|------------------|-----------------------------------|
| 10A..... | 1 | Azimuth circle..... | On base ring..... | Br..... | In 6 sections. |
| 21A2..... | 1 | Auxiliary elevation scale..... | On elevating rack..... | G. S..... | For right side. |
| 21B2..... | 1 | do..... | do..... | G. S..... | For left side. |
| 21E..... | 2 | Auxiliary elevation pointers..... | On top carriage..... | B. Z..... | |
| U45M..... | 1 | Armament chest..... | With 4 carriages..... | Oak..... | Complete. |
| U45N..... | 1 | Bar screw driver..... | In armament chest..... | S..... | 0.375 square. |
| U45AA..... | 1 | do..... | do..... | S..... | 0.625 square. |
| 5A1..... | 1 | Base ring..... | On platform..... | C. I. No. 2..... | 1.5 square. |
| 6D..... | 32 | Bolts, tap..... | Floor-plate bracket to base ring..... | S..... | 1 by 3. |
| 9B..... | 6 | do..... | In racer clip..... | F. S. No. 3..... | 1.5 by 4. |
| 9E1..... | 8 | do..... | For cap squares (9C1) (9D1)..... | S..... | 2 by 3.875. |
| 9H..... | 38 | do..... | For dust guard..... | S..... | 0.5 by 1. |
| 20F..... | 2 | do..... | In elevating shaft bushing..... | S..... | 0.75 by 1.5. |
| 14D..... | 2 | do..... | In spring-box brackets..... | S..... | 2 by 11.5. |
| 16R..... | 4 | do..... | In caps (15G)..... | S..... | 0.5 by 5.062 (5 $\frac{1}{16}$). |
| 17A..... | 4 | do..... | Ladder to racer..... | S..... | 0.75 by 1.5. |
| 17Q..... | 4 | do..... | For equalizing pipe supports..... | S..... | Do. |
| 20F..... | 2 | do..... | 1 for idler pin, 1 for intermediate pin..... | S..... | Do. |
| 21C1..... | 4 | do..... | In auxiliary elevating scale..... | Bz..... | 0.375 by 0.625. |
| 21M..... | 4 | do..... | In elevating rack..... | S..... | 1.375 by 2.625. |
| 23D..... | 8 | do..... | In pedestal cover..... | S..... | 0.375 by 1.125. |
| 23L..... | 8 | do..... | In pedestal..... | S..... | 1 by 3. |
| 5B..... | 16 | Bolts, tap (special)..... | In base ring..... | S..... | 2 by 4.125. |
| 10C..... | 2 | do..... | For azimuth pointer..... | Bz..... | 0.5 by 0.75. |
| 15J..... | 2 | do..... | For drip pan..... | S..... | 0.75 by 0.75. |
| 7C..... | 36 | Bolts, with crown nuts..... | For distance ring..... | S..... | 1 by 3.625. |

12-INCH MORTAR CARRIAGE, MODEL OF 1896 Mm—Continued.

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|--------------------------------|---|------------------|---------------------------------|
| 9Q..... | 40 | Bolts, with nuts..... | For dust guard..... | S..... | 0.5 by 1.875. |
| 15B..... | 8 | do..... | In recoil cylinders..... | F. S. No. 3..... | 1.5 by 5.125. |
| 17B..... | 4 | do..... | 2 in ladder, 2 in equalizing pipe supports..... | S..... | 0.75 by 1.875. |
| 19Q..... | 1 | Bolt, with crown nut..... | For clutch-spring adjusting nut..... | F. S..... | 0.625 by 5. |
| U44AB..... | 1 | Box wrench..... | In armament chest..... | F. S..... | |
| 7E..... | 48 | Bushings..... | On traversing rollers..... | Bz. No. 4..... | |
| 11E..... | 2 | do..... | In top carriage..... | Bz. No. 3..... | For pawl shaft. |
| 11G..... | 1 | do..... | do..... | Bz. No. 3..... | Do. |
| 11J1..... | 4 | do..... | do..... | Bz. No. 4..... | For fulcrum pins. |
| 12A..... | 1 | do..... | do..... | Bz. No. 4..... | For elevating hand-wheel shaft. |
| 12B..... | 1 | do..... | do..... | Bz. No. 4..... | Do. |
| 12C..... | 1 | do..... | do..... | Bz. No. 4..... | Do. |
| 12D..... | 1 | do..... | do..... | Bz. No. 4..... | For elevating shaft. |
| 14C..... | 2 | do..... | In spring-box brackets..... | Bz. No. 3..... | |
| 14Q..... | 5 | do..... | In washers (14 P)..... | Bz. No. 3..... | |
| 15F..... | 2 | do..... | In lower end of recoil cylinder..... | Bz..... | |
| 16J..... | 4 | do..... | In crossheads..... | Bz. No. 4..... | |
| 19M..... | 1 | do..... | On intermediate pin..... | Bz. No. 4..... | |
| 19N..... | 1 | do..... | do..... | Bz. No. 4..... | |
| 23A..... | 1 | do..... | In pedestal..... | Bz..... | |
| 23B..... | 1 | do..... | do..... | Bz..... | |
| 23F..... | 1 | do..... | In traversing shaft bracket..... | Bz..... | |
| 23J..... | 1 | do..... | In pedestal..... | Bz..... | |
| 9F..... | 4 | Bushings (in halves)..... | In bearings on racer..... | Bz. No. 4..... | 2 right, 2 left. |
| 15G..... | 2 | Caps..... | On guides (15C) and (15D)..... | C. S. No. 3..... | |
| 9C1..... | 2 | Cap squares..... | On racer..... | C. S. No. 1..... | On right side. |
| 9D1..... | 2 | do..... | do..... | C. S. No. 1..... | On left side. |
| 11A..... | 1 | do..... | On top carriage..... | C. S. No. 2..... | On right side. |
| 11B..... | 1 | do..... | do..... | C. S. No. 2..... | On left side. |
| 9M..... | 2 | Clamp rings..... | On dust guard..... | S..... | In 4 sections. |
| 19F..... | 1 | Clutch spring..... | On elevating shaft..... | Sp. S..... | |
| 19G..... | 1 | Clutch-spring plate..... | do..... | C. S..... | |
| 19H..... | 1 | Clutch-adjusting nut..... | do..... | F. S..... | |
| 10D..... | 1 | Coaming..... | On racer..... | C. S..... | Over azimuth pointer. |
| 22L..... | 1 | Collar..... | On traversing worm shaft..... | S..... | |
| 17N..... | 4 | Collars..... | On equalizing pipe..... | S..... | Part of pipe connection. |
| 20AA..... | 2 | Collar nuts..... | On elevating handwheel shaft..... | F. S..... | |
| 5C..... | 1 | Core-hold cover..... | On racer..... | C. I..... | Removable. |
| 8F..... | 17 | Core-hold covers..... | do..... | C. I..... | Leaded in place. |
| 13A..... | 25 | Counter-recoil springs..... | On spring guide rods..... | Sp. S..... | Outer. |
| 13B..... | 25 | do..... | do..... | Sp. S..... | Inner. |
| 16H1..... | 2 | Crossheads..... | Between guides..... | F. S. No. 3..... | 1 right, 1 left. |
| 22F..... | 1 | Crown nut..... | On traversing vertical shaft..... | S..... | |
| 16M..... | 2 | Cylinder heads..... | In recoil cylinders..... | Bz. No. 4..... | |
| 12G..... | 1 | Depression stop..... | On top carriage..... | Bz. No. 3..... | |
| 20T..... | 1 | Direction plate (clamp)..... | On collar nut..... | Bz..... | On left side. |
| 20V..... | 1 | Direction plate..... | On right elevating handwheel..... | Bz..... | Elevate. |
| 20W..... | 1 | do..... | On left elevating handwheel..... | Bz..... | Do. |
| 20BA..... | 1 | do..... | On right elevating handwheel..... | Bz..... | Depress. |
| 20CA..... | 1 | do..... | On left elevating handwheel..... | Bz..... | Do. |
| 7A1..... | 1 | Distance ring..... | Between racer and base ring..... | C. S..... | In 6 sections. |
| U43L..... | 1 | Double wrench..... | In armament chest..... | F. S..... | 2 and 2.5. |
| U43J..... | 1 | do..... | do..... | F. S..... | 1.5 and 1.75. |
| U43AK..... | 1 | do..... | do..... | F. S..... | 1.25 and 1.375. |
| U43AN..... | 1 | do..... | do..... | F. S..... | 1 and 1.125. |
| U43F..... | 1 | do..... | do..... | F. S..... | 0.825 and 0.75. |
| U43C..... | 1 | do..... | do..... | F. S..... | 0.375 and 0.5. |
| | 4 | Dowel pins..... | In auxiliary elevation pointer..... | Br..... | 0.1875 by 0.5. |
| 23R..... | 2 | Drain plugs..... | In pedestal..... | Bz..... | |
| 17H..... | 1 | Drain plug..... | In emptying coupling..... | S..... | |
| | 2 | Drip pans..... | For stuffing boxes..... | S..... | |
| 9L1..... | 1 | Dust guard..... | Inside racer..... | S..... | In 4 sections. |
| 19A..... | 1 | Elevating gear..... | On elevating shaft..... | Bz. No. 4..... | |
| 19C..... | 1 | Elevating gear bushing..... | do..... | F. S..... | |
| 19E..... | 1 | Elevating handwheel shaft..... | On elevating handwheel shaft..... | F. S. No. 2..... | |

12-INCH MORTAR CARRIAGE, MODEL OF 1896 Mod—Continued.

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|------------------------------|--|-----------------------------|---|
| 19P..... | 1 | Elevating idler pinion gear. | On idler pin. | Bz. No. 4. | |
| 19D..... | 1 | Elevating pinion. | On elevating shaft. | F. S. No. A. | |
| 21L..... | 1 | Elevating rack. | On gun. | C. S. No. 3. | |
| 20A..... | 1 | Elevating shaft. | In top carriage. | F. S. No. 3. | |
| 12F..... | 1 | Elevating shaft bushing. | do. | Bz. No. 4. | |
| 17J1..... | 1 | Emptying coupling. | On equalizing pipe. | F. S. No. 2 or C. S. No. 3. | |
| 17R..... | 1 | Equalizing pipe. | Under recoil cylinders. | S. | In two parts. |
| 17K..... | 1 | Equalizing pipe support. | Under recoil cylinder. | S. | Right. |
| 17L..... | 1 | do. | do. | S. | Left. |
| 9P..... | 1 | Felt ring. | Attached to dust guard. | Felt. | In 4 sections. |
| U46F1..... | 1 | Filling funnel. | In armament chest. | C. | |
| 15A..... | 4 | Filling plug. | In recoil cylinders. | Bz. | Including 2 extra. |
| 6A..... | 16 | Floor plates. | On brackets. | C. I. | |
| 6C1..... | 16 | Floor plate brackets. | Under floor plates. | C. S. | |
| 16D..... | 4 | Followers. | In recoil cylinder and cylinder heads. | Bz. No. 3. | |
| 17P1..... | 4 | do. | On equalizing pipe. | Bz. No. 3. | Part of pipe connection. |
| 19J..... | 5 | Friction discs. | On elevating shaft. | C. I. | Inner. |
| 19K..... | 5 | do. | do. | Bz. No. 4. | Outer. |
| 16G..... | 2 | Front liners. | On crossheads (16H1). | Bz. | |
| 12J..... | 2 | Fulcrum pins. | In racer. | F. S. No. 3. | |
| 8E..... | 1 | Gasket. | Under core-hole cover (8C). | S. R. | 0.062 (1/16) thick. |
| 16N..... | 2 | Gaskets. | In cylinder heads (16M). | F. V. F. | |
| 17G..... | 1 | Gasket. | In emptying coupling. | F. V. F. | |
| 17M..... | 4 | Gaskets. | On equalizing pipe. | F. V. F. | Part of pipe connection. |
| 16E..... | 4 | Glands. | On followers (16D). | F. S. | In halves. |
| 15C..... | 2 | Guides. | On recoil cylinders. | C. S. No. 3. | Front. |
| 15D..... | 2 | do. | do. | C. S. No. 3. | Rear. |
| 23P..... | 1 | Handle. | On traversing handwheel. | S. | |
| 20Z..... | 4 | Handy oilers. | In crossheads. | | Commercial. |
| 20Z..... | 1 | Hand nut. | On elevating handwheel shaft. | F. S. | |
| 20B..... | 1 | Handwheel shaft. | In top carriage. | F. S. No. 2. | For elevating. |
| 20P..... | 1 | Hub (A). | For left elevating handwheel. | S. | |
| 20L..... | 1 | Hub. | For right elevating handwheel. | S. | |
| 20E..... | 1 | Idler pin. | In top carriage. | F. S. No. 2. | |
| 19L..... | 1 | Intermediate gear. | On intermediate pin. | F. S. No. 2. | Pinion and gear. |
| 20G..... | 1 | Intermediate pin. | In top carriage. | F. S. No. 3. | |
| 22N..... | 1 | Key. | In traversing worm shaft. | S. | |
| 20D..... | 1 | do. | In handwheel shaft (20B). | S. | |
| 20C..... | 1 | do. | do. | S. | |
| 22J..... | 2 | Key 0.375x0.437(1/4)x2.5. | do. | S. | Staked in. |
| 22J..... | 2 | Keys. | In vertical traversing shaft. | S. | |
| 22G..... | 2 | do. | do. | S. | |
| 22G..... | 2 | do. | In fulcrum pins. | S. | |
| 19B..... | 3 | do. | In elevating gear (19A). | F. S. | For racer. |
| 19B..... | 4 | do. | In elevating shaft. | S. | Riveted in. |
| 17C..... | 1 | Ladder. | In pit. | S. | Staked in. |
| 17D..... | 2 | Ladder angles. | On ladder (17C). | S. | Attached to racer. |
| 17E..... | 1 | Lanyard bracket support. | Attached to racer. | S. | |
| 9K..... | 4 | Latches. | On dust guard. | S. | |
| 9J..... | 4 | Latch retainers. | do. | S. | |
| 5C..... | 16 | Leveling plates. | Under base ring. | S. | |
| 10F..... | 1 | Lid. | On coaming (10D). | C. S. | 0.75 by 5 square. Over azimuth pointer. |
| U47S..... | 4 | Lifting hooks. | In armament chest. | S. | |
| U46A..... | 1 | Name plate (No. 2). | On top carriage. | Bz. | |
| U46A..... | 2 | Oilers, half pint. | In armament chest. | S. | Commercial. |
| U46B..... | 1 | Oiler, locomotive, 1 qt. | do. | S. | Do. |
| Q3C..... | 20 | Oil plugs, 0.375 standard. | In carriage. | Bz. | |
| Q3K..... | 18 | Oil plugs 0.625 standard. | do. | Bz. | |
| 8A..... | 4 | Oil tubes. | In racer for oiling distance ring. | Br. | Seamless drawn No. 14 A. W. G. 0.064 thick. |
| 21G..... | 30 | Packing rings. | In recoil cylinders. | G. W. H. P. | 6 extras. |
| 21H..... | 1 | Pawl. | On pawl shaft. | F. S. | |
| 21J..... | 1 | Pawl lever. | In top carriage. | F. S. | |
| 21J..... | 1 | Pawl-lever stop. | do. | S. | |
| 21P..... | 1 | Pawl shaft. | do. | F. S. No. 3. | |
| 21K..... | 1 | Pawl spring. | Between pawl and top carriage. | Sp. S. | |

12-INCH MORTAR CARRIAGE, MODEL OF 1896 Mm—Continued.

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|-----------------------------|--|--------------|---------------------------------------|
| 23K..... | 1 | Pedestal..... | On racer..... | C. S. | |
| 23C..... | 1 | Pedestal cover..... | On pedestal..... | C. I. | |
| | 4 | Pins..... | Bushing to crossbead..... | Bz. | 0.375 by 1. |
| | 4 |do..... | In bushing (19M)..... | Bz. | 0.25 by 0.625. |
| | 4 |do..... | In bushing (19N)..... | Bz. | 0.25 by 0.75. |
| | 1 | Pin..... | In pawl..... | S. | |
| | 4 | Pins..... | In bushing (23F)..... | Bz. | 0.25 by 1.5. |
| 10G..... | 1 | Pin..... | Through lid (10F) coaming (10D)..... | S. | 0.5 by 10, riveted. |
| 11F..... | 1 |do..... | In top carriage..... | S. | 0.75 by 1.75, driven. |
| | 8 | Pins..... | Top carriage and bushing..... | Bz. | 0.25, driven. |
| | 2 |do..... | In piston-rod collars (16C1)..... | F. S. | |
| | 4 |do..... | In crossheads..... | Bz. | 0.375 by 1, driven. |
| | 8 |do..... | In guides..... | S. | 0.25 by 2.25. |
| 23H..... | 1 | Pipe..... | In pedestal..... | Br. | |
| 18A..... | 2 | Pistons..... | On piston rods..... | Bz. No. 4 | |
| 16F..... | 2 | Piston-rod nuts..... |do..... | F. S. No. 3 | |
| U43AM1..... | 1 | Piston-rod wrench..... | With carriage..... | F. S. | |
| 16B2..... | 2 | Piston rods..... | In recoil cylinders..... | F. S. No. C. | |
| 16B1..... | 2 | Piston-rod collars..... | On piston rods..... | F. S. No. C. | |
| 16Q..... | 14 | Plates..... | Under caps (15G)..... | Balata | Part of buffer. |
| 16S..... | 12 |do..... |do..... | S. | Do. |
| 16P..... | 2 | Plates, with lands..... |do..... | S. | Do. |
| 17S..... | 3 | Plugs, 1 extra..... | In cylinders..... | Bz. | To replace equalizing pipe. |
| | | | | | For azimuth circle. |
| 10B..... | 1 | Pointer..... | On racer..... | G. S. | |
| 8G2..... | 1 | Racer..... | On base ring..... | C. S. No. 1 | |
| 9A1..... | 2 | Racer clips..... | On racer..... | C. S. No. 3 | |
| 9R1..... | 1 | Racer liner..... |do..... | Bz. No. 4 | In 8 sections. |
| 15H..... | 2 | Recoil cylinders..... | In bearings on racer..... | C. S. No. 3 | 1 right, 1 left. |
| 16K..... | 2 | Rear liners..... | On crossbeads (16H1)..... | Bz. | |
| 20N..... | 2 | Reinforces..... | For elevating handwheels..... | S. | |
| 20K..... | 2 | Rings..... |do..... | S. | |
| | 3 | Rivets, countersunk..... | In elevating gear (19A)..... | S. | For keys. |
| | 12 | Rivets, round-head..... | For elevating handwheels..... | S. | |
| U44GA..... | 1 | Rod for spanner wrench..... | In armament chest..... | S. | |
| 14L..... | 5 | Rod nuts..... | On spring-guide rods..... | F. S. | |
| 14M..... | 5 |do..... |do..... | F. S. | |
| 6B..... | 64 | Screws, countersunk..... | In floor plates..... | Bz. No. 4 | 1 by 2. |
| 7F..... | 144 |do..... | For traversing roller bushings..... | Bz. | 0.25 by 0.75. |
| | | | | | |
| 8B..... | 4 |do..... | For oil holes in racer..... | Bz. | 0.5 by 1. |
| 8D..... | 4 |do..... | For core-hole cover (8C)..... | Bz. | 0.5 by 1.5. |
| 9S..... | 80 |do..... | In racer liner..... | Bz. | 0.5 by 1.25. |
| 7F1..... | 42 |do..... | In azimuth circle..... | Bz. | 0.375 by 0.75. |
| 10E..... | 12 |do..... | In coaming (10D)..... | S. | 0.5 by 1.25. |
| 16L..... | 40 |do..... | In crosshead liners..... | Bz. | 0.375 by 1.125. |
| 17F..... | 2 |do..... | In lanyard bracket support (17E)..... | S. | 0.75 by 1.5. |
| 9G..... | 24 | Screws, flister head..... | For bushings in side frames of racer..... | Bz. | 0.5 by 0.875. |
| 12H..... | 4 |do..... | In depression stop..... | Bz. | 0.625 by 1.875. |
| 12E..... | 16 |do..... | In trunnion bushings (11C)..... | Bz. | 0.5 by 0.875. |
| 21N..... | 2 |do..... | In elevating rack..... | S. | 1.375 by 2.625. |
| 22D..... | 24 |do..... | For traversing rack..... | S. | 0.75 by 2.75. |
| 11K..... | 8 | Screws, headless..... | In bushings (11J1)..... | S. | 0.5 by 1.25. |
| | 30 | Screw pins..... | In tubes (14H)..... | Bz. | 0.25 by 0.75. |
| 20U..... | 2 | Screws, round-head..... | For direction plate..... | Bz. | 0.125 by 0.312 ($\frac{1}{8}$). |
| 20X..... | 12 |do..... |do..... | Bz. | 0.25 by 0.5. |
| 21F..... | 4 |do..... | In top carriage through auxiliary elevation pointer..... | S. | 0.5 by 1.25. |
| | | | | | |
| | 2 |do..... | For name plate..... | Bz. | 0.25 by 0.5. |
| 20R..... | 2 | Sleeves..... | For elevating bandwheel bands..... | Br. | |
| U44T..... | 1 | Spanner wrench..... | In armament chest..... | F. S. | 3. |
| U44HA..... | 1 |do..... |do..... | C. S. | For lower followers. |
| U44W..... | 1 |do..... |do..... | F. S. | 4.625. |
| | 1 | Split pin..... | In taper pin..... | S. | For elevating pinion. |
| | 1 |do..... |do..... | S. | For elevating bandwheel shaft pinion. |
| | 2 | Split pins..... | In taper pins..... | S. | For collar nuts. |
| | 2 |do..... | In taper pins of fulcrum pins..... | S. | 0.203 ($\frac{1}{4}$) by 1.25. |
| | 1 | Split pin..... | In taper pin..... | S. | For traversing pinion. |
| | 1 |do..... | In crown nut (22F)..... | S. | |
| | 1 |do..... | In taper pin..... | S. | |
| | 5 | Split pins..... | In washer nut (12N)..... | S. | In collar (22L). |
| 20J..... | 12 | Spokes..... | For elevating bandwheel..... | S. | 0.156 ($\frac{1}{4}$) by 1. |

2-INCH MORTAR CARRIAGE, MODEL OF 1896 Mm—Continued.

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|--------------------------------|---|----------------------|------------------------------------|
| 14A1..... | 1 | Spring-box bracket.... | Under racer..... | C. S..... | Right. |
| 14B1..... | 1 |do..... |do..... | C. S..... | Left. |
| 14J..... | 1 | Spring box..... | In spring-box brackets.... | C. S..... | |
| 14F..... | 1 | Spring cap..... | On spring-guide rods..... | C. S..... | |
| U47BL..... | 5 | Spring-compressor screws..... | In armament chest..... | S..... | |
| U44BM..... | 5 | Spring-compressor nuts..... |do..... | S..... | |
| U47BN..... | 5 | Spring-compressor washers..... |do..... | C. I..... | |
| 14G..... | 5 | Spring-guide rods..... | In counter-recoil springs.... | F. S. No. 3.... | |
| 14R..... | 5 | Spring-guide rod plugs..... | In end of spring-guide rods..... | Bz..... | |
| U43AL..... | 2 | Spring-rod wrenches..... | With carriage..... | F. S..... | |
| 14K..... | 15 | Spring separators..... | On spring-guide rods..... | S..... | |
| 20Q..... | 2 | Stems..... | For elevating handwheel handles..... | S..... | |
| 14E..... | 14 | Studs with nuts..... | In spring-box brackets.... | S..... | |
| 15E..... | 8 |do..... | In guides (15C) and (15D).... | S..... | 1.25 by 6. |
| 23G..... | 4 |do..... | For traversing shaft bracket..... | S..... | 1.25 by 5.125. |
| 11P..... | 4 |do..... | In top carriage..... | F. S. No. 3.... | 2.5 by 9.75. |
| 9N..... | 1 | Supporting ring..... | On dust guard..... | S..... | In 4 sections. |
| | 2 | Taper pins..... | In fulcrum pins..... | S..... | 0.842 by 1.5. |
| | 1 | Taper pin..... | In elevating pinion (19D).... | S..... | 0.398 by 4.5. |
| | 1 |do..... | In elevating handwheel shaft pinion (19E).... | S..... | 0.279 by 3.125. |
| | 2 | Taper pins..... | In collar nuts (20AA).... | S..... | 0.279 by 3.437 (3 $\frac{1}{4}$). |
| | 2 |do..... | In pawl..... | S..... | 0.279 by 3.125. |
| | 1 | Taper pin..... | In pawl lever..... | S..... | 0.279 by 3.125. |
| | 1 |do..... | In traversing pinion..... | S..... | 0.581 by 7. |
| | 1 |do..... | In collar (22L)..... | S..... | 0.279 by 3.75. |
| | 1 |do..... | In traversing handwheel..... | S..... | 0.398 by 4.25. |
| | 5 | Taper pins..... | Washer nut (14N)..... | S..... | 0.581 by 5.625. |
| 11H2..... | 1 | Top carriage..... | On fulcrum pins..... | C. S. No. 3.... | |
| 23E..... | 1 | Traversing shaft bracket..... | Under racer..... | C. I..... | For vertical traversing shaft. |
| 23M..... | 1 | Traversing handwheel..... | On traversing handwheel shaft..... | C. I. No. 2.... | |
| 22B1..... | 1 | Traversing pinion..... | On vertical traversing shaft..... | Bz. No. 2.... | |
| 22C..... | 1 | Traversing rack..... | On base ring..... | F. S..... | In 6 sections. |
| 7D1..... | 24 | Traversing rollers..... | In distance ring..... | C. S. No. 3.... | |
| 7G..... | 24 | Traversing roller pins..... | In traversing rollers..... | S..... | |
| 22K..... | 1 | Traversing worm shaft..... | In pedestal..... | F. S. No. 3.... | |
| 22M..... | 1 | Traversing worm..... | On traversing worm shaft..... | S..... | |
| 11C..... | 2 | Trunnion bushings..... | In top carriage..... | Bz. No. 4.... | In halves. |
| 14H..... | 5 | Tubes..... | On spring-guide rods..... | Br..... | |
| 23N..... | 1 | Tube..... | On traversing handwheel handle..... | Br..... | |
| 22H..... | 1 | Vertical traversing shaft..... | In pedestal..... | F. S. No. 1.... | |
| 14P..... | 5 | Washers..... | On spring-guide rods..... | F. S..... | |
| 20H..... | 1 |do..... | On handwheel shaft (20B).... | Bz..... | |
| 20M..... | 2 |do..... | For elevating handwheels.... | S..... | |
| 20S..... | 2 |do..... | For elevating handwheel handles..... | S..... | |
| 21D..... | 4 |do..... | Under auxiliary elevation scales..... | Bz..... | |
| 22E..... | 1 | Washer..... | On vertical traversing shaft..... | S..... | |
| 23Q..... | 1 |do..... | On traversing handwheel handle..... | S..... | |
| 14N..... | 5 | Washer nuts..... | On spring-guide rods..... | F. S..... | |
| U47BD..... | 4 | Water buckets..... | With carriage..... | Indurated fiber..... | Commercial. |
| 22A..... | 1 | Worm wheel..... | On vertical traversing shaft..... | Bz. No. 2.... | |
| U45AB..... | 1 | Wrench..... | In armament chest..... | S..... | For screw driver. |
| U43Q..... | 3 | Wrenches (single)..... |do..... | F. S..... | For filling plug. |

ELECTRICAL EQUIPMENT—LIGHTING AND FIRING CIRCUITS.

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|----------------------|-----|-------------------------------|---|-------------|--------------------|
| E22L..... | 2 | Bases..... | Azimuth lamp junction box. | Roxite..... | |
| E21F or E21J..... | 1 | Base..... | For junction box..... | do..... | |
| E25M..... | 4 | Bases..... | For receptacles (E25H), (J), and (AB). | do..... | |
| T95C..... | 1 | Base bracket..... | In pit..... | C. S..... | |
| P57A E..... | 1 | Roat snap hook..... | On mortar..... | S..... | Commercial. |
| P57A F..... | 1 | Boat snap-hook screw..... | do..... | S..... | Special. |
| E20C..... | 2 | Bolts, tap..... | For plug box (E20 B)..... | S..... | 0.25 by 0.875. |
| T91R..... | 12 | do..... | For straps (T91F)..... | S..... | 0.5 by 1. |
| T95R..... | 2 | do..... | Quadrant lamp bracket..... | S..... | 0.75 by 1.5. |
| T95 Y..... | 3 | Bolts, 2 nuts with each..... | In base bracket..... | S..... | 0.75 by 8. |
| T95Q..... | 1 | Bracket..... | Quadrant lamp bracket..... | Bz..... | |
| E23E..... | 2 | Bushings..... | For receptacles (E25H) and (E25J). | H. R..... | |
| V23A M..... | 1 | Bushing..... | In plug box (E20B)..... | M. H..... | Commercial. |
| | 1 | Cable (firing circuit)..... | Inlet to receptacle on racer. | | 13 ft. 4 in. long. |
| | 1 | do..... | Receptacle on racer to primer. | | 5 ft. 6 in. long. |
| | 1 | Cable (lighting circuit)..... | Inlet to receptacle on racer. | | 11 ft. 4 in. long. |
| E12X..... | 2 | Cable thimbles..... | For firing cables..... | G. I..... | |
| E12N A..... | 2 | Candelabra lamps..... | Elevation quadrant and azimuth pointer. | | Commercial. |
| E13A J1..... | 2 | Receptacle, candelabra..... | Quadrant and azimuth lamps. | V. A..... | |
| E23L..... | 4 | Chains..... | For receptacles (E25H), (J), and (AB). | Br..... | |
| E23K..... | 4 | Chain pivots..... | do..... | Br..... | |
| E21K or E21N..... | 2 | Connection strips..... | For junction box..... | C..... | |
| E21M or E21L..... | 2 | do..... | do..... | Br..... | |
| E25K..... | 8 | Connector strips..... | For receptacles (E25H), (J), and (AB). | C..... | |
| E25S..... | 1 | Contact housing..... | For plug (E25AA)..... | Bz..... | |
| E25T..... | 3 | Contact housings..... | For plugs (E25Z) and (E25AD). | Bz..... | |
| P57M..... | 1 | Contact pin..... | Part of circuit breaker (P57AK). | Bz..... | |
| E25P..... | 8 | Contact strips..... | For plugs..... | C..... | |
| E25R..... | 2 | Contact terminals..... | For plugs (E25Z) and (E25AA). | Hemit..... | |
| E25AC..... | 2 | do..... | For plug (E25AD)..... | Hemit..... | |
| E22AB..... | 2 | Couplings..... | On reflectors..... | Bz..... | |
| E22C..... | 1 | Cover..... | Azimuth lamp junction box. | Br..... | |
| T95S..... | 1 | do..... | Quadrant lamp bracket..... | Bz..... | |
| E21D..... | 1 | do..... | For junction box..... | Bz..... | |
| E25E..... | 2 | Covers (firing)..... | For receptacles (E25H) and (E25J). | Bz..... | |
| E25G..... | 2 | Covers (lighting)..... | For receptacle (E25AB)..... | Bz..... | |
| | 1 | Expansion hook 0.375 by 6. | In pit..... | S..... | Do. |
| | 1 | Expansion hook 0.375 by 3.5. | do..... | S..... | To. |
| T95E..... | 1 | Eyebolt..... | In base bracket..... | F. S..... | |
| E25Y..... | 4 | Flange washers..... | For plugs (E25Z), (E25AA), and (E25AD). | S..... | |
| | 1 | Armored cable..... | Junction box to quadrant lamp. | S..... | 7 ft. 8 in. |
| | 1 | do..... | Junction box to azimuth lamp. | S..... | 16 ft. 10 in. |
| | 1 | do..... | Junction box to portable lamp plug box. | S..... | 4 ft. 2 in. |
| E22E..... | 1 | Gasket..... | Azimuth lamp junction box. | R..... | |
| T95T..... | 1 | do..... | Quadrant lamp bracket..... | R..... | |
| E21C..... | 1 | do..... | For junction box..... | R..... | |
| E25D..... | 4 | Gaskets..... | For receptacles..... | S. R..... | |
| E23M..... | 4 | do..... | do..... | S. R..... | |
| E23AD..... | 4 | do..... | For plugs (E25Z), (E25AA), and (E25AD). | S. R..... | |
| E22J..... | 1 | Gland..... | Azimuth lamp junction box. | Bz..... | |
| E21Y..... | 5 | Glands..... | For terminal tube..... | Bz..... | |
| E25W..... | 4 | do..... | For receptacles (E25H) and (E25AB). | Bz..... | |
| F23AB..... | 5 | do..... | Receptacle and plug..... | Bz..... | |
| E25V..... | 4 | Gland rings..... | For receptacles (E25H) and (E25AB). | Bz..... | Terminal tube. |

ELECTRICAL EQUIPMENT—LIGHTING AND FIRING CIRCUITS—Continued.

| Place mark. | No. | Name of part. | Location. | Material. | Remarks. |
|----------------------|-----|-----------------------------------|--|-------------|-----------------------------------|
| E21X..... | 5 | Gland rings..... | For terminal tube. | Bz..... | |
| P57E..... | 2 | Handles..... | Part of plugs (P57D). | H. R..... | |
| E21H..... | 1 | Insulation piece..... | In junction box. | Mica..... | |
| E25N..... | 4 | Insulation pieces..... | For receptacles. | Mica..... | |
| E21A..... | 1 | Junction box..... | For junction box. | Bz..... | |
| E21T or E21U..... | 1 | Junction box (complete). | Racer. | | Separate parts listed. |
| E20A..... | 1 | Lamp cable (portable). | For carriage. | | Furnished by Engineer Department. |
| E22X..... | 1 | Lamp fitting..... | Quadrant lamp. | Bz..... | |
| E22A..... | 1 | Lamp junction box..... | Lamp junction box. | Bz..... | |
| E22N..... | 1 | Lamp junction box (complete). | In racer for azimuth lamp. | | Separate parts listed. |
| E12Q1..... | 2 | Lamp springs..... | In reflectors. | P. Bz..... | |
| E22G..... | 4 | Nuts, hexagonal..... | Azimuth lamp junction box. | Br..... | |
| E21S..... | 16 | do..... | In junction box (E21T) or (E21U). | Br..... | |
| E23T..... | 16 | do..... | For receptacles. | Br..... | |
| E22K..... | 1 | Packing..... | Terminal tubes. | Flax..... | |
| | 1 | do..... | Azimuth lamp junction box. | Flax..... | |
| | 4 | Packing rings..... | For plugs (E25Z), (E25AA), and (E25AD). | Flax..... | |
| | 4 | do..... | For receptacles (E25H), (J), and (AB). | Flax..... | |
| | 5 | do..... | Terminal tube. | Flax..... | |
| E20B..... | 1 | Plug box..... | On racer. | | Furnished by Engineer Department. |
| E23AC..... | 3 | Plug caps..... | For plugs (E25Z) and (E25AD). | Bz..... | |
| E25AD..... | 2 | Plugs (complete)..... | In receptacle (E25AB)..... | | Separate parts listed. |
| E25AA..... | 1 | Plug (complete)..... | In receptacle (E25J)..... | Do..... | Do. |
| E25Z..... | 1 | do..... | In receptacle (E25H)..... | Do..... | Do. |
| E21E..... | 1 | Plumber's chain..... | Attached to cover (E21D)..... | Br..... | |
| | 1 | do..... | Attached to plug (E25AA)..... | Br..... | Commercial. |
| | 1 | Pulley block..... | In pit..... | Do..... | Do. |
| T95P..... | 1 | Quadrant lamp bracket (complete). | On guide..... | | Separate parts listed. |
| E25B..... | 1 | Receptacle box..... | For receptacle (E25J)..... | Bz..... | |
| E23J..... | 4 | Receptacle caps..... | For receptacles..... | Bz..... | |
| E25H..... | 1 | Receptacle (complete)..... | On base ring in pit..... | Bz..... | Do. |
| E25J..... | 1 | do..... | On racer..... | Bz..... | Do. |
| E25AB..... | 2 | Receptacles (complete)..... | On base ring in pit and racer. | Bz..... | Do. |
| E25A..... | 3 | Receptacle boxes..... | For receptacles..... | Bz..... | |
| T95L..... | 2 | Receptacle studs..... | On racer..... | Bz..... | Do. |
| E12P2..... | 2 | Reflectors..... | Azimuth and quadrant lamps. | Br..... | |
| | 2 | Sash chains..... | Receptacle studs..... | | Commercial. |
| E22B..... | 2 | Screws, filler head..... | Azimuth lamp junction box. | S..... | 0.375 by 1. |
| E22D..... | 6 | do..... | do..... | Br..... | 0.164 by 0.437 ($\frac{1}{8}$). |
| E22F..... | 4 | do..... | do..... | Br..... | 0.190 by 0.875. |
| E22M..... | 4 | do..... | do..... | S..... | 0.190 by 0.562 ($\frac{1}{8}$). |
| E22T..... | 4 | do..... | Quadrant lamp bracket..... | Br..... | 0.190 by 0.5. |
| E21B..... | 2 | do..... | For junction box..... | S..... | 0.375 by 1. |
| E21G..... | 2 | do..... | do..... | Br..... | 0.190 by 0.45. |
| E21P..... | 6 | do..... | do..... | Br..... | 0.190 by 0.75. |
| E21Q..... | 2 | do..... | do..... | S..... | 0.190 by 0.875. |
| E25C..... | 8 | do..... | For receptacles..... | S..... | 0.375 by 0.875. |
| E25F..... | 16 | do..... | do..... | Br..... | 0.164 by 0.45. |
| E23D..... | 8 | do..... | do..... | Br..... | 0.164 by 0.45. |
| E23S..... | 16 | do..... | For receptacles (E25H), (J), (AB). | Br..... | 0.164 by 0.625. |
| E25U..... | 8 | Screws, headless..... | For plugs (E25Z), (E25AA), (E25AD). | Br..... | Special. |
| | 2 | Screws, round head..... | Junction box..... | Br..... | 0.190 by 0.2. |
| E25Q..... | 8 | do..... | For plugs (E25Z), (E25AA), (E25AD). | Br..... | 0.138 by 0.125. |
| | 2 | do..... | Receptacle studs..... | Br..... | |
| P57K..... | 4 | Screws, special..... | For circuit breaker..... | S..... | |
| | 2 | Split pins..... | Receptacle studs..... | Br..... | |
| T95A..... | 1 | Spring..... | On wire hook..... | Sp. S..... | |
| T95M..... | 2 | Studs..... | Receptacle studs..... | Bz..... | |
| T91F..... | 12 | Straps..... | Flexible conduit to racer..... | S..... | |
| E25X..... | 4 | Stuffing tubes..... | For receptacles and terminal tubes (E25H) and (E25AB). | Bz..... | |
| E25L..... | 8 | Terminal clips..... | For receptacles..... | Ph. Bz..... | |
| E21W..... | 5 | Terminal tubes..... | Terminal tubes..... | Bz..... | |

ELECTRICAL EQUIPMENT—LIGHTING AND FIRING CIRCUITS—Continued.

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|----------------------------|------------------------------------|-----------|------------------------------------|
| E21Z. | 5 | Terminal tubes (complete). | Junction box and plug boxes. | Bz. | Separate parts listed. |
| E25AE. | 2 | do. | On receptacles (E25AB) and (E25H). | | On engineer cable, type I, in pit. |
| E22H. | 4 | Washers. | Azimuth lamp junction box. | Br. | |
| E21R. | 8 | do. | For junction box. | Br. | |
| T65B. | 1 | Wire hook. | In racer. | F.S. | |

SHOT, TRUCKS TYPE 12MD (TWO PER-CARRIAGE).

| | | | | | |
|--------|----|----------------------------|-------------------------------|--------------|----------------------------------|
| | 2 | Arms. | In rear o. frame. | S. | 1 right, 1 left. |
| 29G1. | 1 | Axle. | In axle bracket. | F.S. | |
| 23K. | 1 | Axle bracket. | On frame. | C.S. | Left. |
| 26J. | 1 | do. | do. | C.S. | Right. |
| A48A. | 15 | Bolts, with crown nuts | For wheels (A48J) and (A48P). | S. | |
| 28E. | 4 | do. | For brake-shaft brackets. | S. | |
| N19B. | 4 | Bolts, with nuts. | In buffer cylinder. | S. | 0.75 by 1.625. |
| 23H. | 1 | Brake lever. | On brake shaft. | F.S. | |
| 29G2. | 1 | Brake shaft. | In brake-shaft brackets. | F.S. | |
| 25D. | 2 | Brake-shaft brackets. | On axle brackets. | Bz. | |
| 26A. | 1 | Bracket. | Rear of truck. | Bz. | |
| 25F1. | 2 | Brake shoes. | On brake shaft. | C.S. | |
| N19A. | 1 | Buffer cylinder. | On front of frame. | C.S. No. 2. | |
| N19E. | 1 | Buffer spring. | In buffer cylinder. | Sp. S. | |
| A48H. | 2 | Bushings. | In wheels (A48J). | Bz. | |
| A48R. | 1 | do. | In wheel (A48B). | Bz. | |
| | 1 | Cap. | On piston rod. | Bz. | |
| 29C. | 1 | Caster. | In bracket (28A). | C. S. No. 3. | |
| 25B. | 1 | Caster collar. | On caster. | F.S. | |
| 29B. | 1 | Caster wheel pin. | In caster. | F.S. | |
| | 2 | Crown nuts. | On axle. | S. | |
| N19F. | 1 | Cylinder head. | In buffer cylinder. | F.S. | |
| N19C. | 2 | Filling and drain plugs. | do. | Bz. | |
| | 1 | Gasket. | On cylinder head. | C. | |
| N19G1. | 2 | Glands. | In buffer cylinder. | Bz. | |
| 29A. | 1 | Handle. | In handle bands. | Ash. | |
| 29C. | 2 | Handle bands. | On frame. | F.S. | |
| | 1 | Key. | In brake shaft. | S. | 0.437 ($\frac{1}{16}$) square. |
| Q3C. | 4 | Oil plugs 0.375. | On truck. | Bz. | |
| | 8 | Packing rings. | In buffer cylinder. | G. W. H. P. | |
| | 1 | Pin. | In cap on piston rod. | S. | |
| | 1 | do. | On piston and rod. | S. | |
| | 2 | Pins. | In handle. | Bz. | |
| N19D. | 1 | Piston and rod (complete). | In buffer cylinder. | F.S. | |
| | 2 | Plates. | In frame. | S. | |
| 40 | 40 | Rivets. | do. | W. I. | 0.75. |
| | 16 | do. | do. | W. I. | 0.5. |
| | 5 | do. | In tray. | W. I. | 0.75. |
| | 2 | do. | In tray support. | W. I. | 0.05. |
| 29 E. | 1 | Shot tray. | On frame. | S. | |
| 29D. | 1 | Shot-tray end. | On shot tray. | S. | |
| | 2 | Side braces. | In frame. | S. | 1 right, 1 left. |
| | 2 | Side frames (lower). | Part of frame. | S. | Do. |
| | 2 | Side frames (upper). | do. | S. | Do. |
| | 1 | Split pin. | For taper pin. | S. | For caster collar. |
| | 4 | do. | For bolts (28E). | S. | |
| | 2 | do. | For taper pin. | S. | For brake shoes. |
| | 1 | do. | do. | S. | For brake lever. |
| | 1 | do. | In caster-wheel pin. | S. | |
| | 2 | do. | In axle. | S. | |
| | 15 | do. | For bolts (A48A). | S. | |
| 29J. | 1 | Stop. | On shot tray. | C. S. | |
| 29F. | 1 | Stop support. | do. | S. | |
| | 2 | Supports. | Under tray. | S. | |
| | 1 | Taper pin. | For caster collar. | S. | |
| | 2 | Taper pins. | For brake shoes. | S. | |
| | 1 | Taper pin. | For brake lever. | S. | |
| | 2 | Taper pins. | In axle. | S. | |
| A48S. | 1 | Tire. | On wheel (A48P). | Rubber. | |
| A48J. | 2 | Tires. | On wheels (A48F). | Rubber. | |
| 29H. | 1 | Tray support. | On shot tray. | Bz. | |
| A48P. | 2 | Washers. | On axle. | S. | |
| A48F. | 1 | Wheel. | In caster. | C. S. | |
| A48G. | 2 | Wheels. | On axle. | C. S. | |
| A48Q. | 2 | Wheel rims. | On wheel (A48F). | C. S. | |
| A48Q. | 1 | Wheel rim. | On wheel (A48P). | C. S. | |

SHOT TONGS (ONE PER CARRIAGE).

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|-------------------|--------------------------------------|-----------|-----------------------------|
| A8G..... | 1 | Claw, inner..... | Opposite outer claw..... | S..... | In 2 parts. Do. |
| A8H..... | 1 | Claw, outer..... | Pivoted on center pin..... | S..... | |
| A8L..... | 1 | Dog..... |do..... | S..... | Riveted to claw. Do. |
| A8M..... | 1 | Pin, center..... | In claws and dog..... | S..... | |
| A8J..... | 1 | Pin, shackle..... | In shackle and outer claw..... | S..... | |
| | 3 | Separators..... | Between two parts of inner claw..... | S..... | |
| | 2 |do..... | Between 2 parts of outer claw..... | S..... | |
| A8K..... | 1 | Shackle..... | On shackle pin and outer claw..... | S..... | Do. |
| | 2 | Split pins..... | In shackle pin..... | S..... | |
| | 2 |do..... | In center pin..... | S..... | |
| | 1 | Spreader..... | In outer claw..... | S..... | |
| | 1 |do..... | In inner claw..... | S..... | |

LANYARD ATTACHMENT.

| | | | | | |
|-----------|---|-----------------------------|---|------------|--------------------------------------|
| N17G..... | 2 | Bolts, with nuts..... | For pulley bracket..... | S..... | Including 2 hooks. |
| N17L..... | 1 | Bridle ring..... | On lanyard (N17C)..... | Sp. S..... | |
| N17A..... | 1 | Button..... | On end of lanyard (N17C)..... | C. S..... | |
| N17B..... | 1 | Hook..... |do..... | F. S..... | |
| N17C..... | 1 | Lanyard (complete)..... | Through racer to breach of gun..... | Hemp..... | |
| N17H..... | 1 | Lanyard pulley..... | In pulley bracket (N17K)..... | Bz..... | For button (N17A). 0.25 by 0.375. |
| N17K..... | 1 | Lanyard pulley bracket..... | On lanyard and bracket support (17E)..... | Bz..... | |
| N17J..... | 1 | Lanyard washer..... | On racer..... | C. S..... | |
| N17F..... | 4 | Screws, countersunk..... | For washer (N17J)..... | S..... | |
| N17E..... | 1 | Split pin..... | In lanyard pulley bracket..... | S..... | |
| | 1 | Washer..... | On pulley bracket..... | S..... | For pulley. |

ELEVATION QUADRANT, MODEL OF 1906.

| | | | | | |
|------------|---|-------------------------------------|---------------------------------|------------------|---|
| R19T..... | 1 | Arm..... | On bubble housing (R19U)..... | Bz..... | 0.04 by 0.12, driven. 0.5 by 1.1. 0.5 by 1.35. Through quadrant support. |
| R19C..... | 1 | Arm sector..... | In arm (R19T)..... | Bz..... | |
| R19CA..... | 1 | + Arm spring..... | In worm sector (R19Z)..... | Ph. Bz..... | |
| R19Q..... | 1 | Arm stop screw..... | In bracket (R19R)..... | S..... | |
| R19R..... | 1 | Bracket..... | On quadrant support (N1A)..... | Bz..... | |
| R19FA..... | 1 | Bubble cover..... | On arm (R19T)..... | Bz..... | |
| R19U..... | 1 | Bubble housing..... | On bracket (R19R)..... | Bz..... | |
| R19X..... | 1 | Bubble housing plug..... | In bubble housing (R19U)..... | Bz..... | |
| R19EA..... | 1 | Bubble housing retaining screw..... |do..... | S..... | |
| | 1 | Cover (complete)..... | For quadrant..... | Cotton duck..... | |
| R19N..... | 1 | Fulcrum pin..... | In bubble housing (R19U)..... | Bz..... | |
| R19E..... | 1 | Level vial..... |do..... | Glass..... | |
| R19K..... | 1 | Locking screw (lower)..... | In worm (R19L)..... | S..... | |
| R19J..... | 1 | Locking screw (upper)..... |do..... | S..... | |
| R19B..... | 1 | Micrometer..... | On worm (R19L)..... | G. S..... | |
| R19P..... | 1 | + Micrometer..... | On micrometer head (R19G)..... | G. S..... | |
| R19F..... | 2 | + Micrometer adjusting screws..... | In micrometer (R19P)..... | S..... | |
| R19G..... | 1 | + Micrometer head..... | For micrometer (R19P)..... | G. S..... | |
| R19D..... | 1 | Micrometer retaining screw..... | In quadrant arm..... | S..... | |
| R19V..... | 1 | Index..... | Under micrometer (R19B)..... | S..... | |
| R19M..... | 1 | Index retaining screw..... | In arm sector (R19C)..... | S..... | |
| | 1 | Pin..... | In worm (R19L)..... | S..... | |
| N1A..... | 1 | Quadrant support..... | On gun trunnion..... | F. S. No. 3..... | |
| N1C..... | 1 | Screw, countersunk..... | In quadrant support (N1A)..... |do..... | |
| N1B..... | 3 | Screws, countersunk..... |do..... | S..... | |
| R19BA..... | 1 | + Screw spring..... | For micrometer (R19P)..... | P. Bz..... | |
| R19AA..... | 2 | Screws, with crown nuts..... | For bracket (R19R)..... | Bz..... | |
| R19A..... | 1 | Sector spring..... | In worm sector (R19Z)..... | P. Bz..... | |
| R198..... | 2 | + Washers..... | For micrometer head (R19G)..... | G. S..... | |
| R19DA..... | 1 | Washer..... | On worm (R19L)..... | S..... | |
| R19L..... | 1 | Worm..... | In arm sector (R19C)..... | S..... | |
| R19Z..... | 1 | Worm sector..... | In arm (R19T)..... | Bz..... | |
| R19H..... | 1 | Worm unit..... | On worm (R19L)..... | Bz..... | |

+Details marked thus apply to quadrants Nos. 1 to 217, inclusive, only.

GREASE CUPS (TWO PER CARRIAGE).

| Piece mark. | No. | Name of part. | Location. | Material. | Remarks. |
|-------------|-----|------------------|---|-------------|----------|
| A2A..... | 1 | Body..... | Screwed into carriage..... | Bz..... | |
| A2B..... | 1 | Cap..... | On upper end of body..... | Bz..... | |
| A2D1..... | 1 | Cup leather..... | Underneath plunger..... | Leather | |
| | 2 | Gaskets..... | Underneath body..... | Copper..... | |
| | 1 | Pin..... | In plunger..... | Bz..... | |
| A2E1..... | 1 | Plunger..... | In body..... | Bz..... | |
| A2G..... | 1 | Plunger nut..... | On plunger..... | Bz..... | |
| A2H..... | 1 | Screw..... | Cup leather to plunger..... | Bz..... | |
| | 1 | Split pin..... | For plunger and plunger nut..... | S..... | |
| A2F..... | 1 | Spring..... | Between cap (A2B) and plunger (A2E1)..... | S..... | |
| A2C1..... | 1 | Washer..... | Under cup leather (A2D1)..... | Bz..... | |

WAR DEPARTMENT,

OFFICE OF THE CHIEF OF ORDNANCE,

Washington, December 13, 1913.

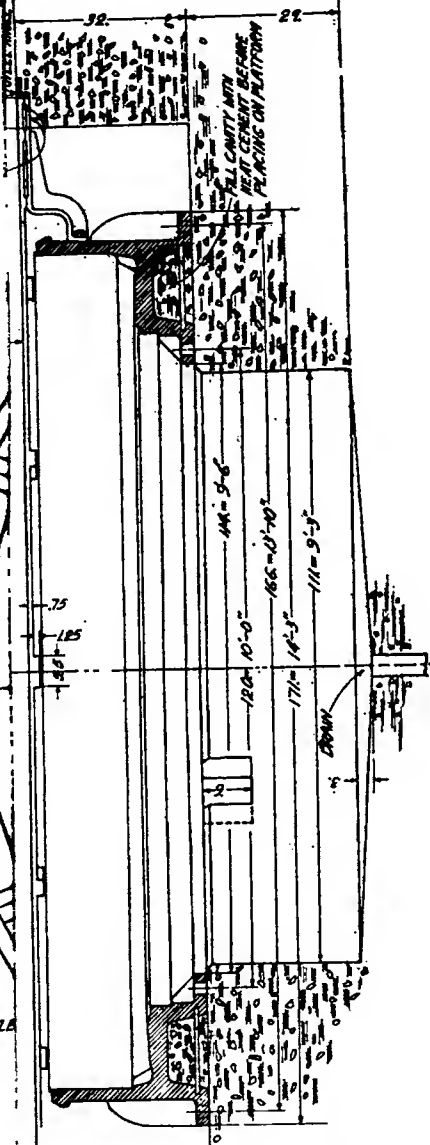
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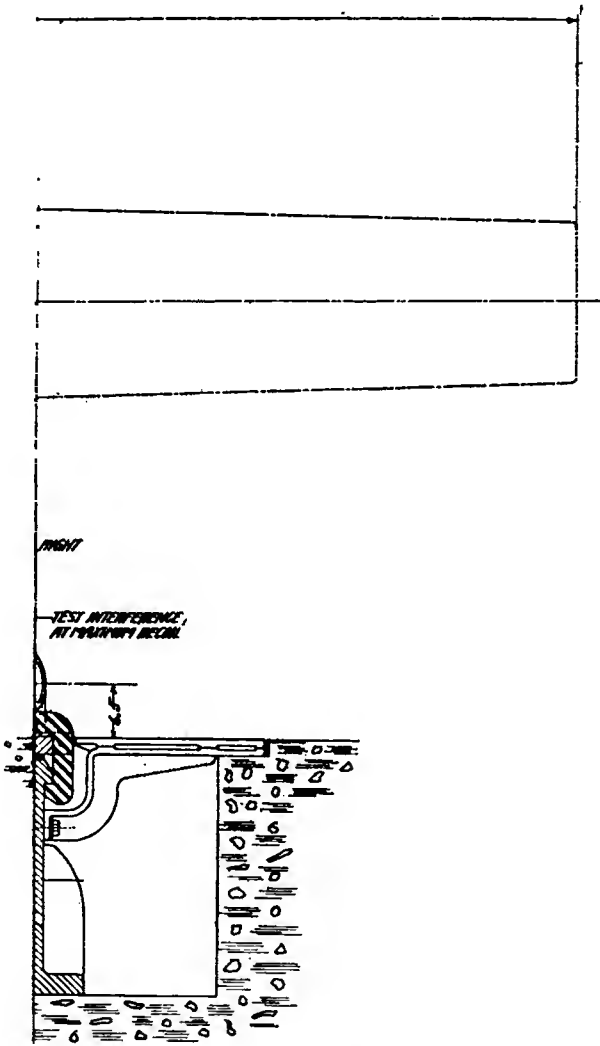
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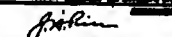



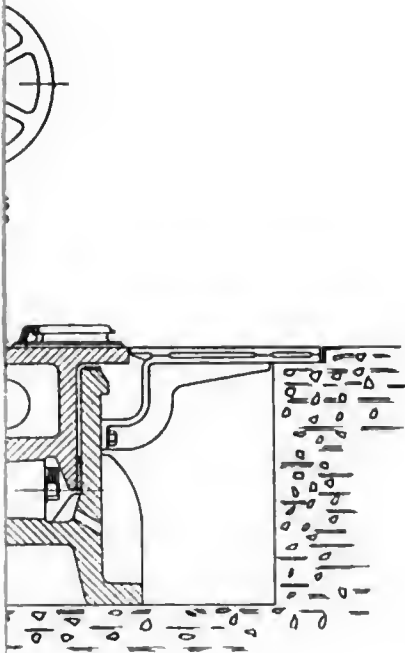
FOR ENGINEER'S CABLE




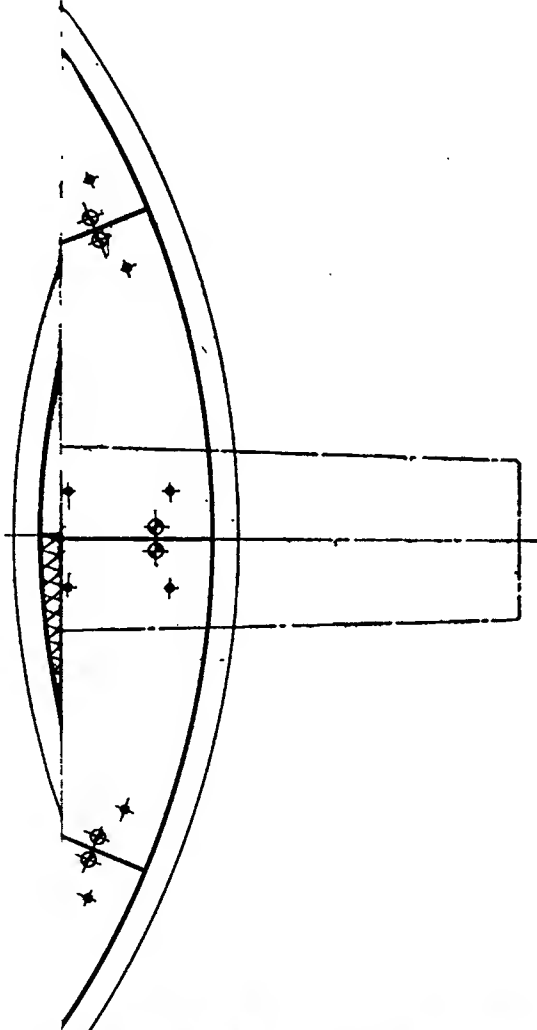
| | | | |
|--|---|--|---|
| REVISED 1 JULY 1912 2 DEC 3 1913 | 12 INCH MORTAR CARRIAGE MODEL OF 1896 MM PLATFORM | |  MAR. 1, 1912 |
| | DESIGNED BY <i>[Signature]</i> R.E.K. JAC. Z.M. 6/1/12 CHECKED BY <i>[Signature]</i> J.M. RICE | | |
| | CLASS 12 DIVISION 15 DRAWING 1 FILE | | |
| | 9978-17. (| | |




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|----------|-------------|---|--|--|
| NO. | REV. | REVISIONS | 12 INCH MORTAR CARRIAGE MODEL 8F 1936 RHM LONGITUDINAL SECTION |  MAR 1, 1932 |
| | | | | |
| | | 1. 12 INCH MORTAR CARRIAGE MODEL 8F 1936 RHM (DEC. 3, 1931) | DESIGNED BY  CHECKED BY  DATE MAR 1, 1932 | ZIM. 540  DATE MAR 1, 1932 |
| CLASS 12 | DIVISION 15 | DRAWING 2 | FILE | |

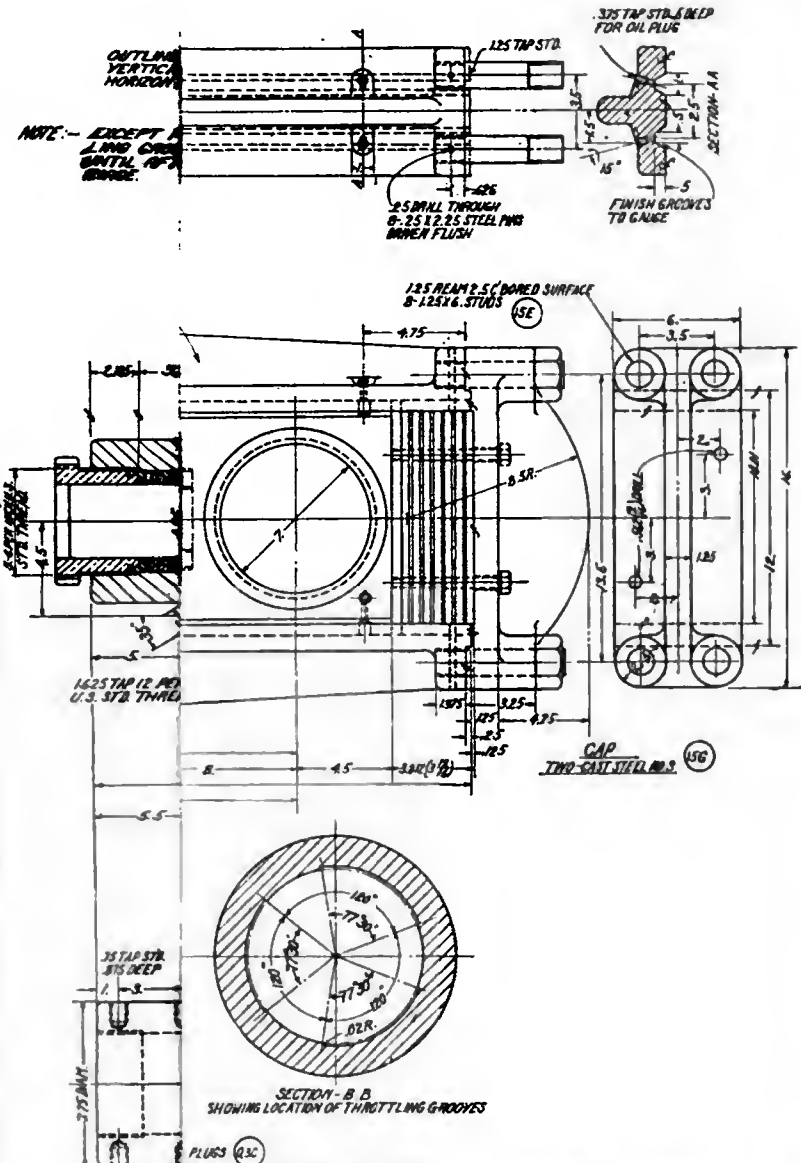


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|-----------|-----------------------------|--|--------------------------------------|---|----------|
| ISSUED TO | REVISIONS | 12 INCH MORTAR CARRIAGE MODEL OF 1896 MHI | |  | |
| | NOV 12, 1913 DEC 3, 1913 | REAR ELEVATION AND SECTION | | | |
| | | DESIGNED BY <i>W. H. M. M. M.</i> | CHECKED BY <i>W. H. M. M. M.</i> | ZIM. 40 | APPROVED |
| | | FORWARDED BY <i>W. H. M. M. M.</i> | RECEIVED BY <i>W. H. M. M. M.</i> | | |
| | | CLASS 12 | DIVISION 15 | DRAWING 3 | FILE |



| | | | | | | | |
|--------|--------|-----------|--|--|-------------|---|------|
| NO. TO | | REVISIONS | | 32 INCH MORTAR CARRIAGE MODEL OF 1896 1501 | |  MAR. 1, 1912 | |
| PLATE | FIGURE | | | PLAN | | | |
| | | | | DESIGNED BY <i>William</i> CHECKED BY <i>Robert</i> | | REC. REC. ZIM. MAR 1912 | |
| | | | | DRAWN BY <i>William</i> CHECKED BY <i>Robert</i> | | APPROVED BY <i>William</i> | |
| | | | | CLASS 12 | DIVISION 15 | DRAWING 4 | FILE |

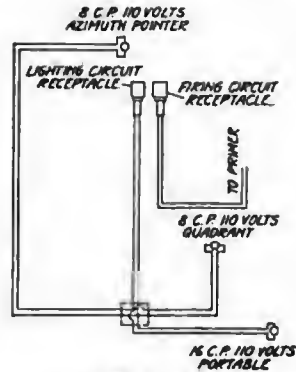
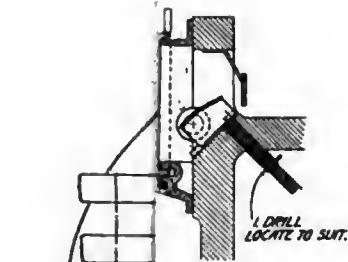
NOTE:— EXCEPT
1. AND 2. ONLY
SHOWN IN
SECTION.



SECTION - B B
SHOWING LOCATION OF THROTTLING GROOVES

| REVISED TO | REVISIONS |
|------------|--------------------|
| 1 | 1.25 TAP STD. |
| 2 | 1.25 DRILL THROUGH |
| 3 | 1.25 TAP STD. |
| 4 | 1.25 DRILL THROUGH |
| 5 | 1.25 TAP STD. |
| 6 | 1.25 DRILL THROUGH |
| 7 | 1.25 TAP STD. |
| 8 | 1.25 DRILL THROUGH |
| 9 | 1.25 TAP STD. |
| 10 | 1.25 DRILL THROUGH |
| 11 | 1.25 TAP STD. |
| 12 | 1.25 DRILL THROUGH |
| 13 | 1.25 TAP STD. |
| 14 | 1.25 DRILL THROUGH |
| 15 | 1.25 TAP STD. |
| 16 | 1.25 DRILL THROUGH |
| 17 | 1.25 TAP STD. |
| 18 | 1.25 DRILL THROUGH |
| 19 | 1.25 TAP STD. |
| 20 | 1.25 DRILL THROUGH |

| | | |
|--|--------------------------------|----------------------|
| 12 INCH MORTAR CARRIAGE MODEL OF 1896. MH | | |
| RECOIL CYLINDER AND GUIDES | | |
| DESIGNED BY <i>W. H. Hillman</i> | CHECKED BY <i>ZIM. 1918</i> | DATE MAR. 1, 1912 |
| APPROVED BY <i>J. H. Hillman</i> | | DATE MAR. 1, 1912 |
| CLASS 12 | | DIVISION 15 |
| DRAWING 15 | | FILE |



WIRING DIAGRAM
FOR 110 VOLT MAIN

LIGHTING CIRCUIT AND FIRING CIRCUIT FROM INLET TO RECEPTABLES ON CARRIAGE TO BE A TWISTED PAIR EACH, 410 CIRCULAR MILS, STRANDED, SILK WOUND, RUBBER COVERED, BRAIDED AND TIAKED.

FIRING CIRCUIT

FROM INLET TO RECEPTABLE ON RACER ————— 13'-6"
FROM RECEPTABLE ON RACER TO PRIMER ————— 5'-6"


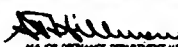
LIGHTING CIRCUIT

FROM INLET TO RECEPTABLE ON RACER ————— 11'-6"

ALL ELECTRIC LIGHTING CABLE, OTHER THAN THE TWISTED PAIR SPECIFIED ABOVE, SHALL BE OF THE THIN CONDUCTOR, LEAD COVERED, STEEL ARMORED TYPE; EACH CONDUCTOR TO BE OF 410 CIRCULAR MILS. THE WHOLE CABLE SHALL BE MADE UP AND TESTED IN ACCORDANCE WITH NAVY SPEC. 15C1, FOR "STANDARD ELECTRICAL CONDUCTORS", DATED DEC. 18, 1912.

FROM JUNCTION BOX TO QUADRANT LAMP ————— 7'-8"
FROM JUNCTION BOX TO AZIMUTH POINTER LAMP ————— 15'-10"
FROM JUNCTION BOX TO PORTABLE LAMP PLUG BOX ————— 4'-2"

12 INCH MORTAR CARRIAGE
MODEL OF 1896 M III
CABLES AND WIRING DIAGRAMS.

| | | | | | | |
|---------------------|----------|-------------|---|--|--|---|
| PER- S TO 12X | REVISORS | | 12 INCH MORTAR CARRIAGE MODEL OF 1896 M III CABLES AND WIRING DIAGRAMS. |  OCT. 23, 1918 | | |
| | | | | | <small>DESIGNED BY:</small> James L. Walsh <small>CAPTAIN, U.S. NAVY</small> | <small>APPROVED BY:</small>  <small>MAJOR, U.S. NAVY</small> |
| | | | | | <small>CHW</small> | <small>CHW</small> |
| | | | | | <small>CHW</small> | <small>CHW</small> |
| | | | <small>NAVY DEPARTMENT, USA</small> | <small>NAVY DEPARTMENT, USA</small> | | |
| | CLASS 12 | DIVISION 15 | DRAWING 32 | FILE | | |